the OIL AND GAS JOURNAL
PUBLISHED WEEKLY SEPTEMBER 19, 1960

What to expect in Canada's new oil policy ▸ 59

That gasoline glut is no sudden thing ▸ 61

Alaskan oil to start paying off ▸ 72

Pipeline to truck – in direct takeoff ▸ 92

How to predict drilling troubles ▸ 105

Some things ahead...

- Half of oil refinery capital going into petrochemicals.
- Russia as an important factor in the world market.
- International proration similar to state proration.
- A surplus of oil for years to come.

As seen by Tom Kimball . . . Sinclair's new executive vice president

p. 62

Where climate or distance may interfere with scheduled inspection, Rockwell-Nordstrom valves with Teflon coated plugs augment routine lubrication.

SPECIAL COATINGS CUT VALVE COSTS

Now, Rockwell-Nordstrom lubricated plug valves are available with special coatings to solve a wide number of corrosion problems that used to require costly special alloy valves.

K-51 (Penton) plastic coatings give iron or steel Rockwell-Nordstrom valves an exceptional corrosion resistance against attack by most acids, caustics and organic-inorganic solvents . . . Kanigen (metallic nickel) coatings assure the corrosion resistance of nickel or stainless steel . . . and Teflon coated plugs assist lubricant efficiency on services where inadequate or infrequent lubrication is anticipated. Whatever your valve needs, for the most difficult services or the easiest ones, the *complete* line of Rockwell-Nordstrom lubricated plug valves can fill your needs better and at lower cost. Write for complete details: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited. Rockwell International S.A., Geneva, Switzerland.

Lubrication Makes The Difference

ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

Be sure to register and vote.

On tank farm service, Kanigen coated Rockwell-Nordstrom valves stay trouble-free on sour crude oil storage.

OIL AND GAS JOURNAL
Vol. 58, No. 38

Contents September 19, 1960

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Factors Which Affect Paraffin Deposition 87

By R. J. Cole and F. W. Jessen

Increased temperature differential at the interface between pipe wall and crude increases paraffin-deposition rate. Wetting characteristics of the pipe surface also have significant influence on the amount of paraffin deposition.

Lease Tip: Gas Cleans Flow-Line Paraffin 95

Use of Glass-Reinforced Plastic Pipe May Increase 96

By Robert M. Levy

Principal uses are in crude-gathering lines, salt-water-disposal lines, and water-flooding operations. As downhole tubing, it has been used in salt-water-disposal wells, pumping wells, and combination injection and disposal wells.

Oil-Well Pumping—15 99

By Joseph Zaba

Why sucker rods fail.

Anticipate Trouble on Drilling Wells 105

By L. E. Wilson

A survey should be made of the general area in which drilling is to take place. An estimate can be made of the amount of trouble which has been experienced at given drilling depths. Then a contingency fund can be set up to take care of anticipated trouble.

Reservoir Engineering—27 113

By E. T. Guerrero and F. M. Stewart

How to find interstitial-water saturation from electric-log data.

Pipelining

Pipeline to Truck—In Direct Takeoff 91

By Donald A. Knoelke

Indiana Standard is using this procedure, even at unattended stations. One direct unattended terminal is now in operation at Trenton, Mo. Other terminals will be built at St. Joseph, Mo., and Constantine and Girard, Mich.

Cutting Turbulence and Reducing Noise in Gas Pipelines 125

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First Packaged CO Boiler is Installed 102

By D. H. Stormont

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World tanker fleet in 1965.

Asphalt Producers Look for Standard Quality Factor 121

By Duane W. Gagle

A critical discussion of asphalt specification tests and avenues being studied to improve them.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Sept. 19, 1960

Alaska's first steady oil payoff starts next month:

First flow of crude from two Kenai pools over a new pipeline to a tanker terminal at Nikiski on Cook Inlet marks a milestone in the new state's oil history.

It also means the first returns on millions of dollars wildcatters have spent in the region.

For interesting details on special problems in producing, moving, and storing crude in the Far North and how operators met them, see p. 72.*

Watch for Phillips to reenter the Alaskan drilling scene in 1961.

Reports in Anchorage say the company is planning a deep wildcat near Humble's Bear Creek failure on the Alaskan peninsula. Phillips took a large offshore lease in the vicinity of Wide Bay at the state sale in December 1959.

Pan Arctic Syndicate is being formed by a group of Canadian companies to develop 4,622,350 acres of permits in in Arctic Islands.

Members of the syndicate are BC Oil Lands, Ltd., Prairie Oil Royalties, Ltd., Place Gas & Oil., Ltd., Penelope Explorations, Ltd., Murcky Fault Metal Mines, Ltd., Indian Mountain Metal Mines, Ltd. American associates are Callahan Mining Corp., Shattuck-Denn Mining Co., Pinnacle Explorations Inc., and Pyramid Oil & Gas Corp.

▼ ▼ ▼

Operators in South Louisiana deep areas have learned to budget extra funds for drilling troubles. Some contractors use $20,000 as an average figure per well. But some companies think $50,000 or even more is realistic.

Statistics tell why: Of wells going below 16,000 ft., 71.4% have serious trouble, and 33.7% of all wells below 10,000 ft. run into some trouble (p. 105).

First carbonated-water flood in Texas will be launched

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

next month by Helmerich & Payne in Pecos County, Texas.

Operator expects first phase involving only 180 acres to cost $380,000 and produce 2,000,000 bbl. of oil that it could not recover otherwise (p. 75).

▼ ▼ ▼

Liquefied methane and propane loom as jet fuels for the future because of the built-in cooling they provide.

As jets fly higher and faster, problem of heat dissipation becomes more and more difficult. Liquefied gases would absorb the excess heat from the engines and leading edges of the plane before being consumed as fuel (p. 78).

Russia may soon start upgrading its motor gasoline in a long-range plan to offer top quality to motorists by 1980. Auto makers and refiners have agreed on a target by then of 100-106 extra, 90-96 premium, and 80-88 regular. The public is now supplied with 93, 74, and 60-octane gasolines.

Italy's ENI may make its first move to market in the Western Hemisphere in Argentina. Italian negotiators are believed ready to offer YPF a better deal on a drilling contract and to build a refinery in order to break into the local market.

Final agreement for 300 wells on the southern flank of Comodoro Rivadavia remains unsigned. But ENI may come out with a contract to drill 600 wells for $30 million.

Two Italian flag vessels also reportedly have been chartered to Russians for Black Sea loading presumably for supplying confiscated Cuban refineries.

Bacteria that "eat" sulfur have substantially cut down offensive smells from smoke stacks of industrial plants, researchers of Bureau of Mines report.

The bacteria oxidize the sulfur in coal as part of their regular metabolic processes. It's the sulfur dioxide, released when coal burns, that causes obnoxious air pollutant.

▼ ▼ ▼

Humble is expanding its tests of a new marketing emblem—ENCO.

The new brand name is now appearing on all Carter Division service stations, billboards, and road signs in eastern Washington and western Montana. Carter introduced the ENCO gasolines to the area a month ago.

First appearance of ENCO brand was in June in Seattle and Portland areas and is now spreading eastward.

Union Oil is issuing "76 autoscript" which may be used as cash for purchases at Union stations. The Autoscript

comes in pads similar to checkbooks. Each sheet is worth $1 and the booklets are available in $5, $10, and $20 sets.

The books may be charged to credit-card accounts and are being promoted as particularly useful for controlling purchases by younger members of the family.

▼ ▼ ▼

Supply of natural-gas liquids from western Canada during next 10 years will barely exceed demand. A glut will not develop with advent of huge gas exports to U. S.

A special study by Stanford Research Institute gives this picture: Propane—potential demand should absorb nearly all production. Butane—surplus of only 7,000 bbl. daily may be available for export by 1963. Pentanes plus—home market is expected to consume most of them (p. 77).

More attention is being focused by the industry on developing a reinforced plastic pipe for high-pressure applications. Key obstacles to overcome: Bending, joining. Thermoplastic materials are making headway in lower-pressure uses, particularly for gas gathering.

Another development in piping: Increased use of glass-reinforced plastic pipe in the battle against corrosion (p. 96).

New plastics made from polyurethane outwear steel yet stretch like rubber. They should find use in such heavy-duty applications as tires for lift trucks, skids for jet planes, and gears.

Polyurethane compounds are made from combination of isocyanates, polyesters, and amines. Products result that are tougher than mild steel but can be stretched to double their length. When force is released, they snap back.

▼ ▼ ▼

Government antitrusters are trying to get the right to look at confidential reports made to Census Bureau by business.

Antitrusters say this would give them valuable information, such as the share of the market held by a particular corporation. This would be very useful in antimerger cases.

Census Bureau officials object. The U. S. Supreme Court is being asked to rule on issue.

Other Washington notes: Commerce Department hopes to have ready for new Congress its study on who benefits from highway-building program...NPC does not plan to meet again until January...FPC has new general counsel—John C. Mason... OCDM is moving ahead on its study of long-range petroleum supply and demand.

Market Memo

Sept. 19, 1960

Refining statistics are doing strange didos.

Crude runs eased off 15,000 bbl. daily last week—to 8,279,000 bbl. daily from 8,294,000 bbl. the week before.

But production of four major products increased by 182,000 bbl. daily to 7,425,700 bbl. daily from 7,243,100. This means refiners had to be using unfinished oils and cracking stocks to supplement crude.

Stocks also took a healthy jump—up 7,658,000 bbl.

Gasoline inventories rose 221,000 bbl. at a time when most marketers expected a decline as suppliers moved to replace products used over the Labor Day holiday.

Distillates jumped sharply by 6,085,000 bbl., kerosine up 637,000 bbl., and residual 715,000 bbl.

The stock increase, strangely, was the largest for any week since the same week last year when a 10,066,000-bbl. jump was recorded.

Gulf Coast markets are quiet but firm, nervously facing the fact that stocks are too high.

Gasoline is not being pushed, but several cargoes are available for late September lifting. Quotations are on the basis of low Gulf Coast of 11.25 cents for 92-RON.

No. 2 is firmly held at 8.25 cents posted price. It needs cold East Coast weather to spur spot activity...Kerosine is available for spot buying at discounts of one-quarter cent off posted price of 9 cents with no buying interest.

No. 6 fuel continues firm at $2.30 per barrel and scarce.

Along Great Lakes Pipe Line, markets are in good shape, with farm demand for gasoline described as good. Discounts of one-quarter cent for gasoline out of Group 3 for northern shipment are reported in at least one spot. Posted prices of 12.5 cents for 91-RON and 15.25 cents for 99-RON are now expected to hold into October.

No. 2 is steady with buyers and sellers at a standoff with both watching the weather and the continued buildup of inventories before making a price move.

Midriver refiners report inventories in satisfactory shape. They are disturbed by lack of inquiries for all products.

Gasoline is being held for Gulf Coast low of 11.25 cents for Memphis area with no buying activity.

No. 2 is being quoted at one-quarter cent over Gulf Coast low of 8.25 cents, but no deals are being closed.

YOU CAN USE A LARGER SHAFT WHEN YOUR "SPECS" READ HYATT

Need a larger shaft without disturbing envelope dimensions? Take advantage of a Hyatt option by omitting the inner race. You can add the thickness of the Hyatt inner race to the shaft and let the rollers operate directly on shaft. Just be sure that the shaft is suitably hardened and ground. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

Replacement bearings available through United Motors System and its authorized bearing distributors.

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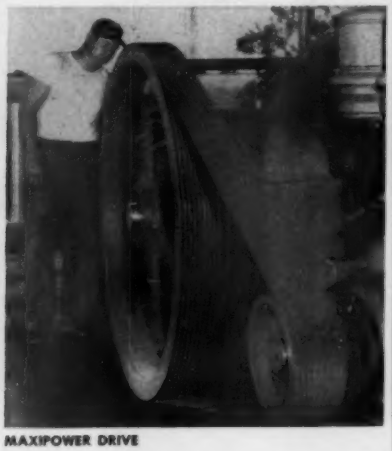
B.F.Goodrich

V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

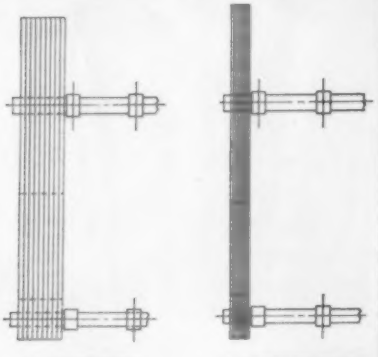
ORDINARY V BELT DRIVE



MAXIPOWER DRIVE

SAVE $402.14 ON V BELT DRIVES—*Costs for* both *sheaves and V belts were cut when B.F. Goodrich Maxipower belts replaced ordinary belts on this drive. Size and weight of sheaves were reduced, smaller and fewer V belts were used*—eight *5V2500 belts replaced* nine *D-240 belts. The result: a $402.14 saving. Costs can be cut as much as 30% by switching to a Maxipower V belt drive.*

How Maxipower V belts reduced bearing load 42%

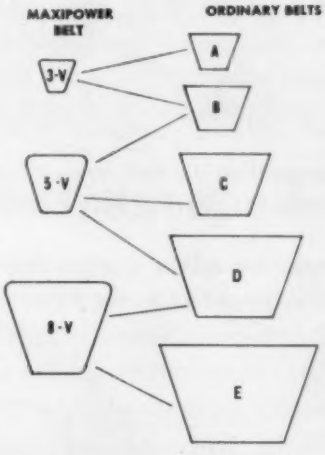


ORDINARY DRIVE — MAXIPOWER DRIVE

In the installation shown above, sheaves for the Maxipower drive are lighter, have a face width of only 5⅛", compared to a 13¼" width for the sheaves on the ordinary drive. Because there's less weight, less shaft overhang, bearing load for this Maxipower drive is 42% less for the driven shaft shown than the drive replaced. This greatly increases bearing life.

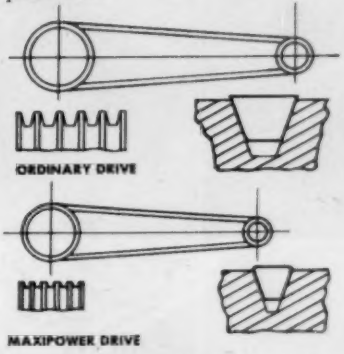
With Maxipower V belts, three cross sections do the work of five

Each cross section of the new B.F. Goodrich Maxipower V belts has been fitted to a particular horsepower range so that only three cross sections are needed instead of the A, B, C, D, and E sections of conventional V belts. The three cross sections are 3V, 5V and 8V.



New BFG Maxipower V belts save space, weight, bearings, dollars

New B.F.Goodrich Maxipower V belts give up to three times the horsepower-carrying capacity in the same amount of space as ordinary belts. This more compact drive gives you more horsepower per dollar, results in substantial savings, both in initial costs and often in belt replacement.



ORDINARY DRIVE — MAXIPOWER DRIVE

In most Maxipower installations, fewer belts and smaller diameter sheaves are used, center distances are shorter. Costs can be cut up to 30%, valuable space is saved. Sheaves have narrower grooves and groove spacing, are smaller, less costly. The smallest sheaves that can safely be used with the drive motor can be installed. Often these will be 50% smaller than present drives. This reduced sheave weight and face width means less shaft overhang, less bearing load—increased bearing life.

The extra strength of Maxipower V belts comes from its new rubber compounds, the tough fibers used in its load-carrying cords, and the new "deep V" design. Because of this design the belt's load-carrying cords are supported so completely that each has an equal share in the load—none "loaf".

All Maxipower V belts are heat-resisting, oil-resisting at no extra cost. Belts with static conducting properties can also be ordered *at no extra cost.*

For further information and help in selecting Maxipower belts for your drives, call your B.F.Goodrich distributor. *B.F.Goodrich Industrial Products Company, Dept. M-909, Akron 18, Ohio.*

B.F.Goodrich V belts

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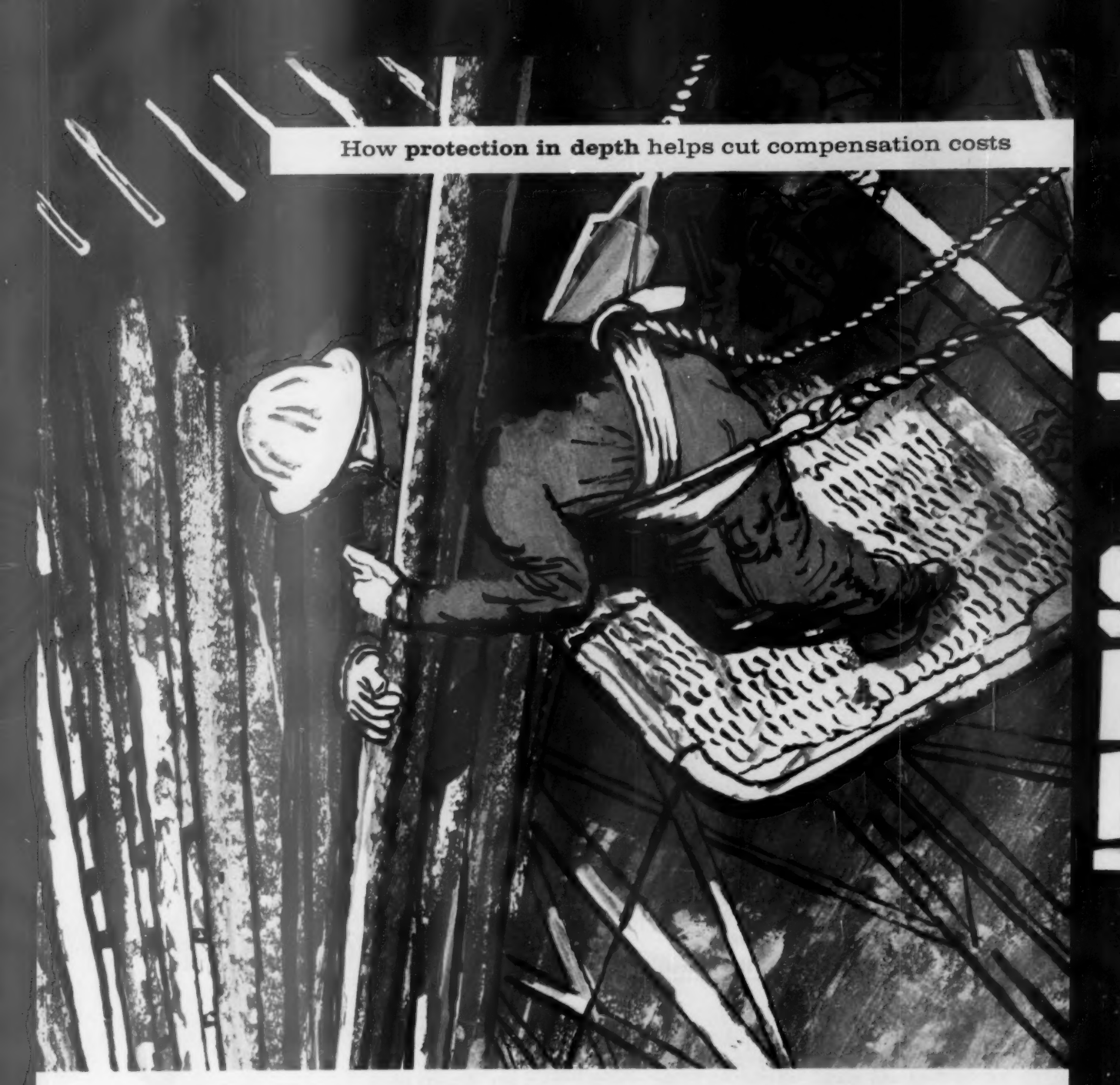

Improving rig safety from spud-in to completion

Liberty Mutual engineers know rigs. They know how to evaluate blowout preventer procedures and check fire protection planning. They know drilling safety, and they know how to get this all-important story across to your crews. Such knowledge and experience in safe drilling practices can help any pusher or driller reduce accidents and losses — and workmen's compensation costs. This safety engineering is but one of the many Liberty Mutual services that add up to protection in depth. For more facts about Liberty's protection in depth and how it can help lower your business insurance costs, contact your nearest Liberty Mutual office.

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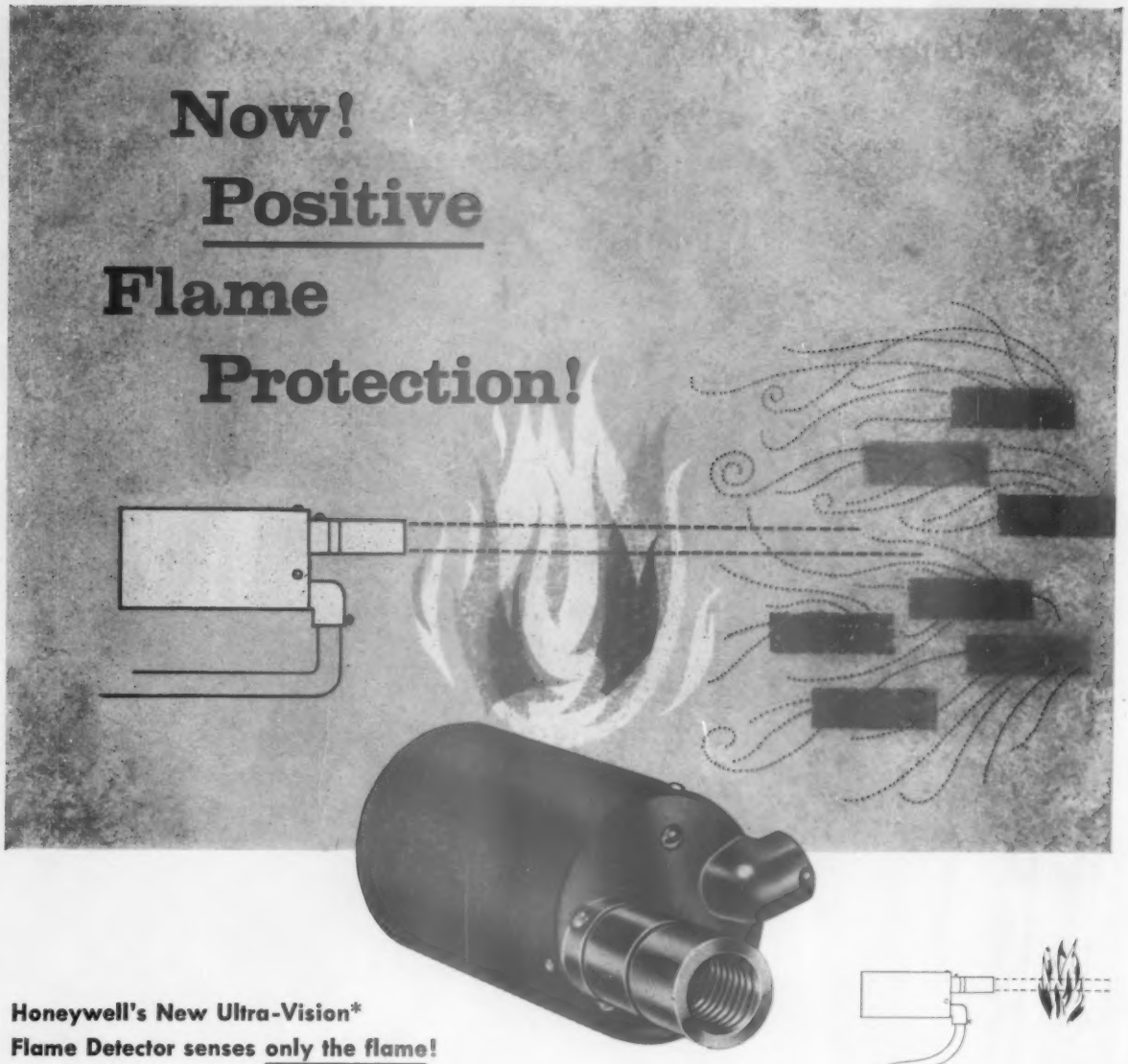
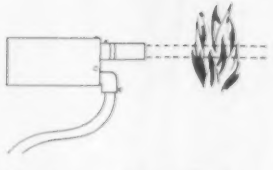
Now! Positive Flame Protection!



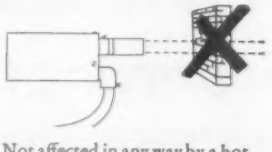
Honeywell's New Ultra-Vision* Flame Detector senses only the flame!

No more hot refractory hold-ins! This new Ultra-Vision Flame Detector responds to nothing but the ultraviolet energy given off by flame and sparks. It's the *only* visual flame detector that can tell the difference between real flame and red-hot refractory or glowing carbon. At last you can be *absolutely sure* that fuel delivery will be stopped in the absence of flame.

Only this compact new control simplifies flame supervision of both single and multiple burners. The Ultra-Vision Detector, not being sensitive to a hot refractory, can be aimed at each individual flame in the most convenient way. Actually pays for itself in simplified installation and maintenance. For all gas, oil and combination gas-oil installations. Get complete details from your nearby Honeywell field engineer. Call him today. Or, write for Bulletin 95-2776, Minneapolis-Honeywell, Minneapolis 8, Minnesota.



Ultra-Vision Flame Detector sights flame of all fuels.



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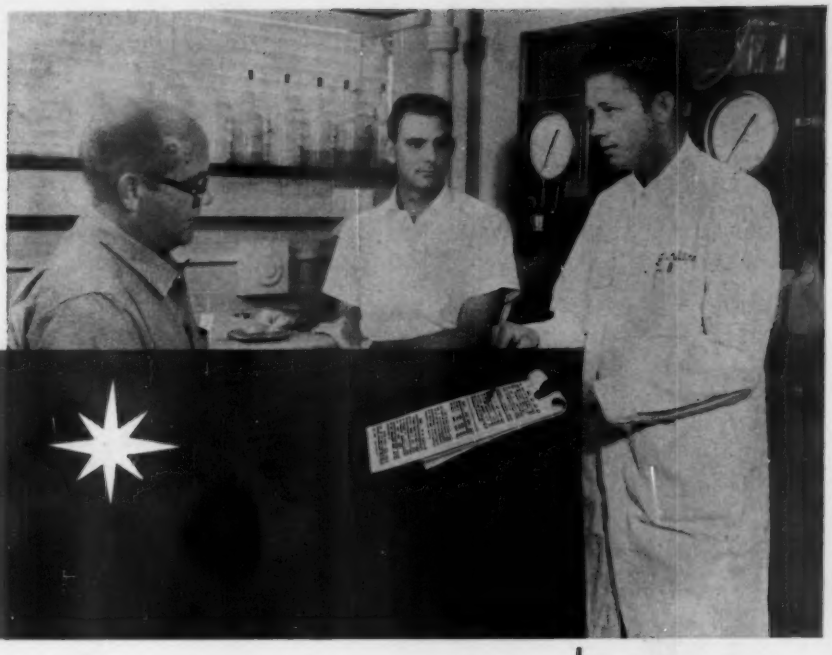

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Offices in Principal Cities

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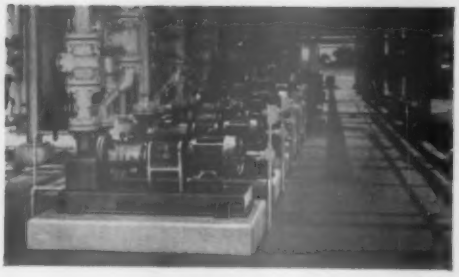


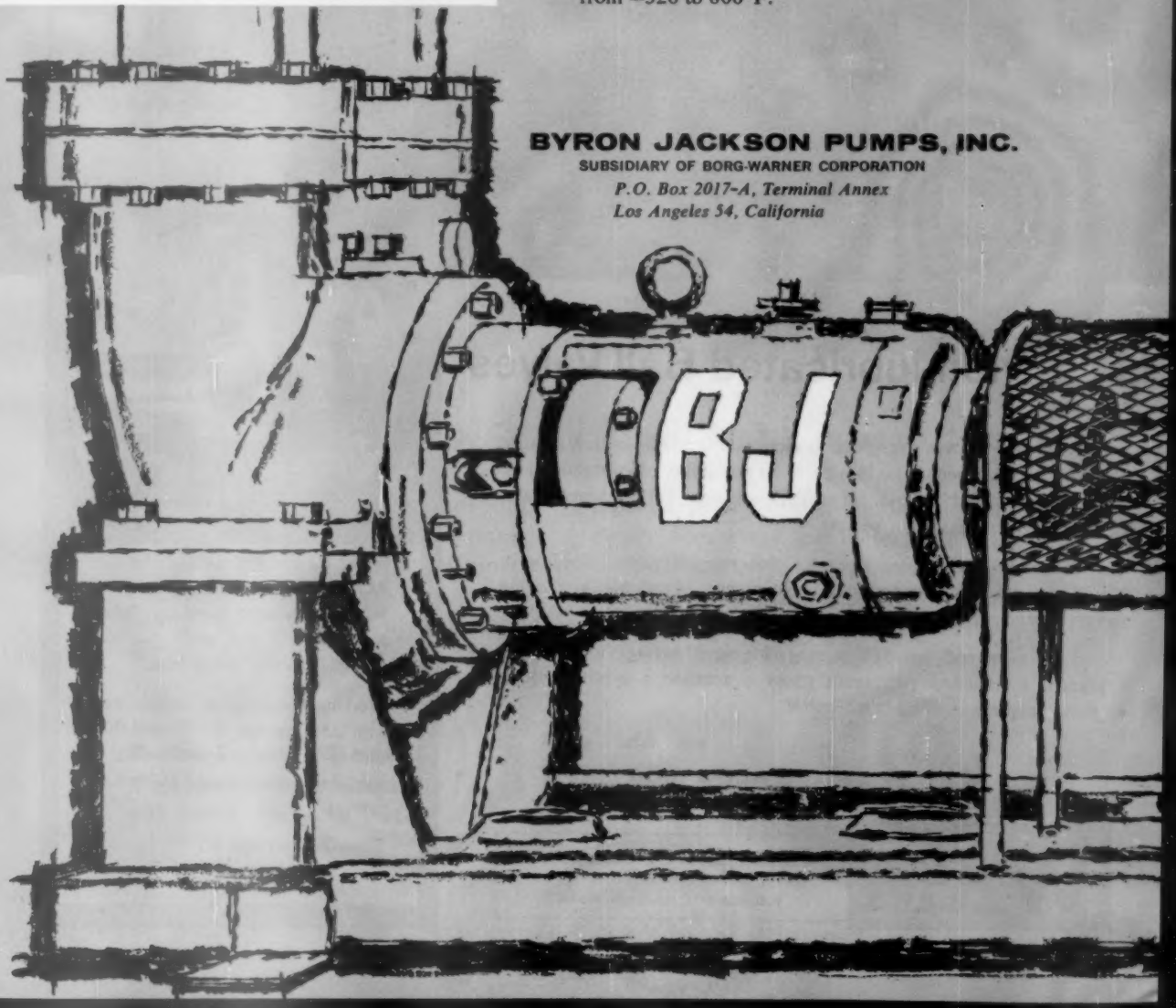
Continental Oil Company uses both SM and SMI model BJ Process Pumps in this Oklahoma field processing plant.

BJ Process Pumps

The ability to keep on stream is the real test of a process pump. Under continuous operation with corrosive or toxic fluids, extreme temperatures and other rugged conditions, it's the quality pump that pays off with long, dependable service.

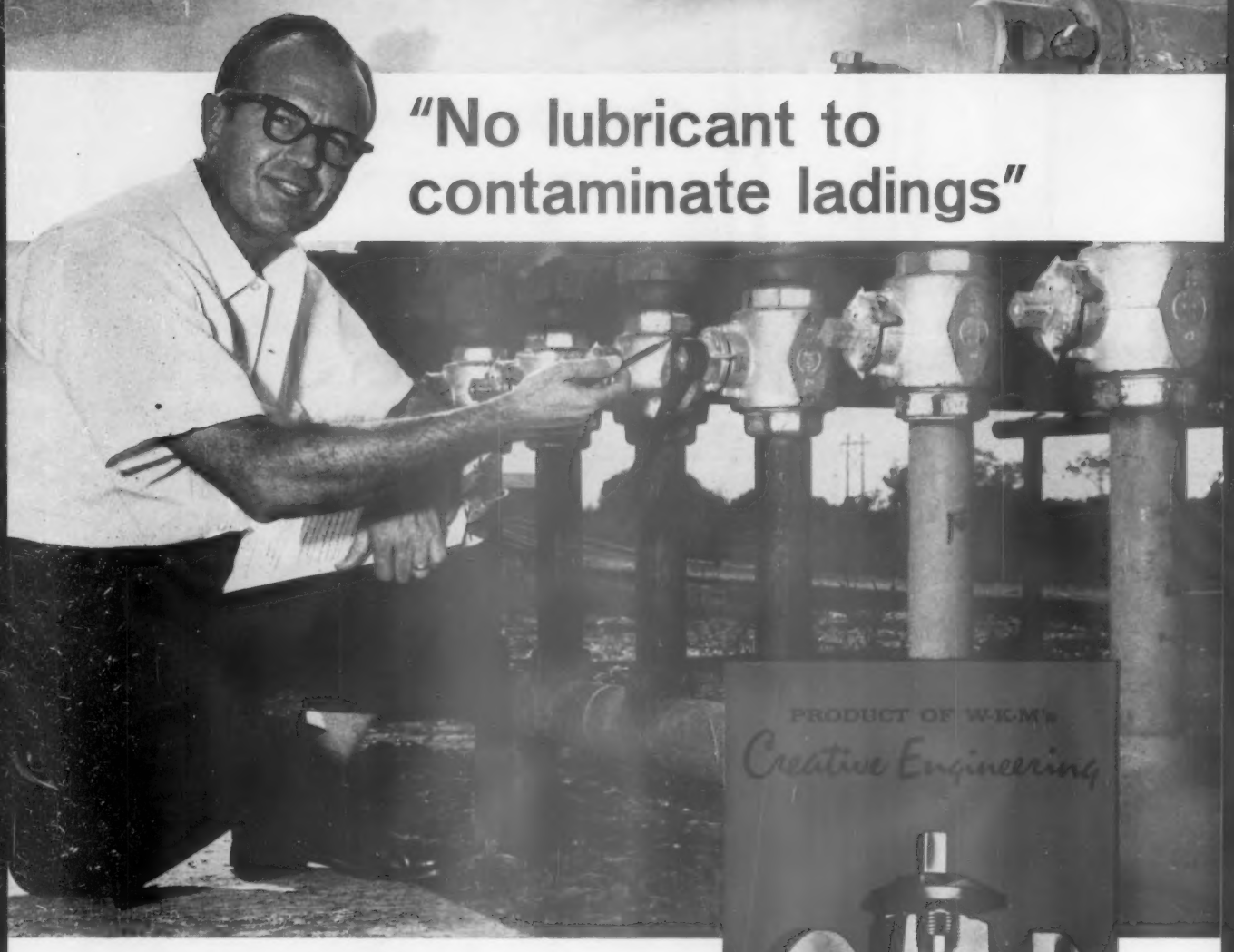
Byron Jackson's quality comes from sound basic design, careful construction, and the backing of a quality manufacturer. BJ's complete line of process pumps puts the right pump on your job—and BJ's quality keeps it there!

Single and double stage models available . . . capacities to 5,000 GPM, heads to 1,900 feet, temperatures from –320 to 800°F.



BYRON JACKSON PUMPS, INC.
SUBSIDIARY OF BORG-WARNER CORPORATION
P.O. Box 2017-A, Terminal Annex
Los Angeles 54, California

"No lubricant to contaminate ladings"



acf® non-lubricated Ball Valves

ACF Ball Valves are specially designed for ladings that require absolute purity. There is no lubricant, no possibility of contamination. The chrome-plated ball is suspended between Teflon seats under compression for leakproof sealing.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available at leading supply stores everywhere.*

Service-proved for 5½ years with such ladings as: gasoline • alkalis • liquefied petroleum gases • acetone • synthetic fuels • paint solvents • toluol • alcohol.

WRITE FOR CATALOG 1000

W-K-M

DIVISION OF acf INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

ACF non-lubricated Ball Valves feature full bore conduits, Teflon stem gaskets and seats that are sealed from the lading flow.

Working Pressures: In carbon steel with ASA ratings of 150 and 300, and a few sizes in ASA 600; in semi-steel with 200 and 400 pound ratings.

Sizes: ½" through 6".

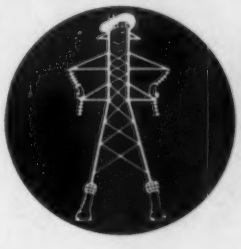
5911-R2

Electricity does it better . . .

Utility electric power is not only dependable but it offers the advantages of low-maintenance and automatic control to release manpower and cut payroll costs. Whether at a gathering station, water-flooding project, on a pipeline, or in a refinery, utility electric power does every job better and cuts over-all costs to a minimum. For information on possible savings in your operation, consult your nearest Utility Electric Power Company today.

Petroleum Electric Power Association
BOX 35006, DALLAS 35, TEXAS

Utility Electric Power saves money, manpower, maintenance and serves you better automatically



A list of P.E.P.A. members will be furnished on request.

The know-how and dedication of the men who use the precision testing equipment shown here for proving every operation in the manufacture of VOGT products is an important factor to the companies who have come to rely on the Engineered Excellence of the VOGT Equipment they buy. As an example, the constantly improved forging, finishing and inspection techniques employed in the manufacture of VOGT forged steel valves, fittings and flanges, have kept them in the forefront for safe and reliable handling of liquids and gases over a wide range of pressures and temperatures found in petroleum refineries, chemical, petro chemical and power plants.

At VOGT no manufacturing procedure is left to chance. All standard measuring instruments such as scales, verniers, calipers, micrometers, indicators, plug gates, etc. are employed with other special precision measuring instruments as shown in these pictures.

This Surfindicator electronically measures surface roughness in micro-inches. Used for "on-the-spot" testing of the surfaces of gaskets, stems, gates, seats, bonnets, etc.

This 30" Optical Comparator reveals contour uniformity and angularity of form tools and provides an elaborate inspection facility for checking formed parts for close tolerances.

A PICTURE STORY OF Quality

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY

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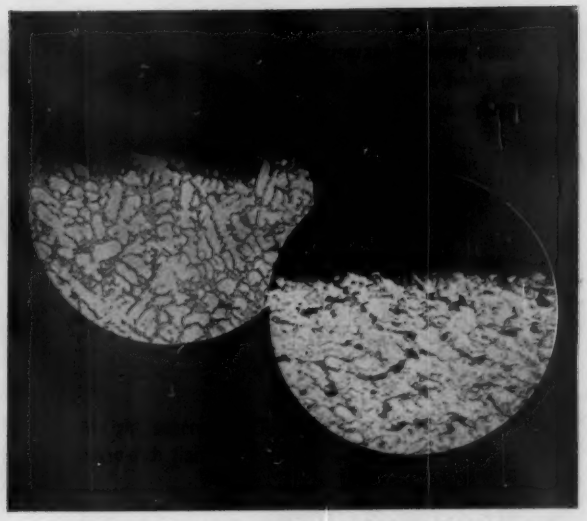
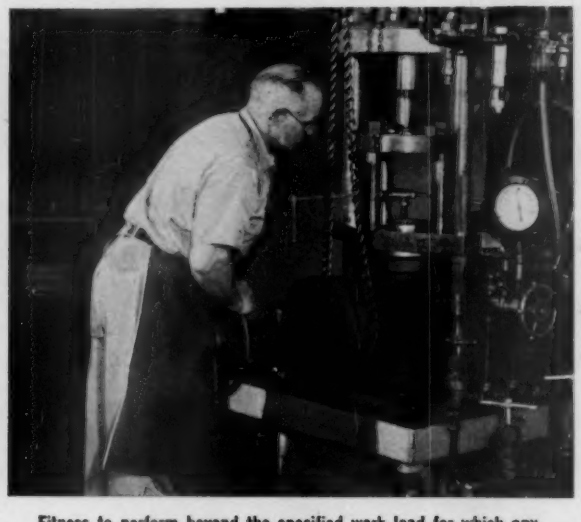
The Balphot Research Metallograph is used for routine and research metallographic examination of the structure of materials.



Special lapping machines provide a 4-6 micro-inch finish on VOGT valve seat rings and gates for positive closure.

Optical flats, used in conjunction with monochromatic light, measure flatness and surface finish of valve gates and seat rings in terms of light bands. Flatness is held to 2 light bands or 0.000022".



Fitness to perform beyond the specified work load for which any VOGT valve is made, is proved by this final hydraulic pressure test with oil, which follows a pneumatic body and seat test with air under water.

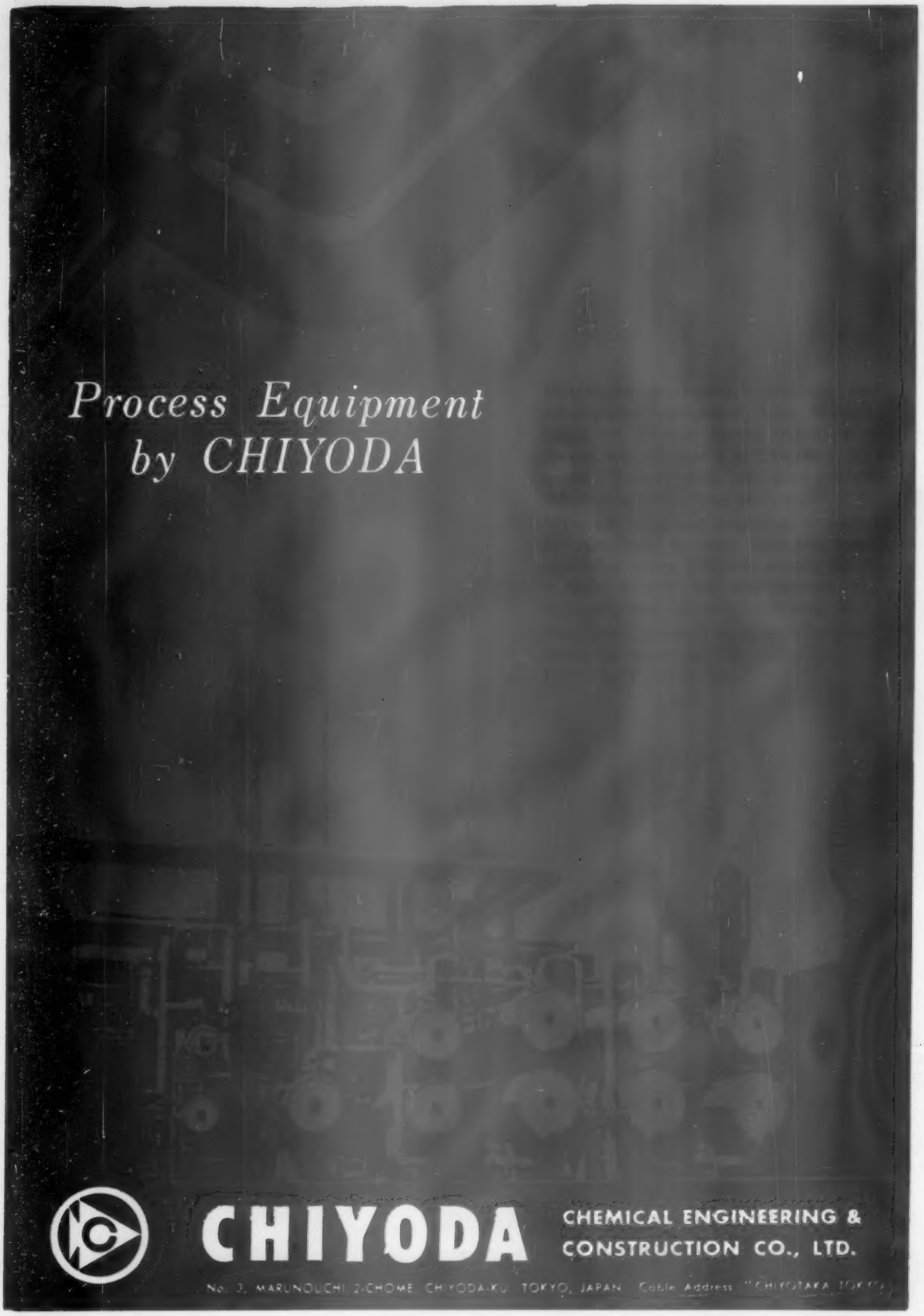
Control

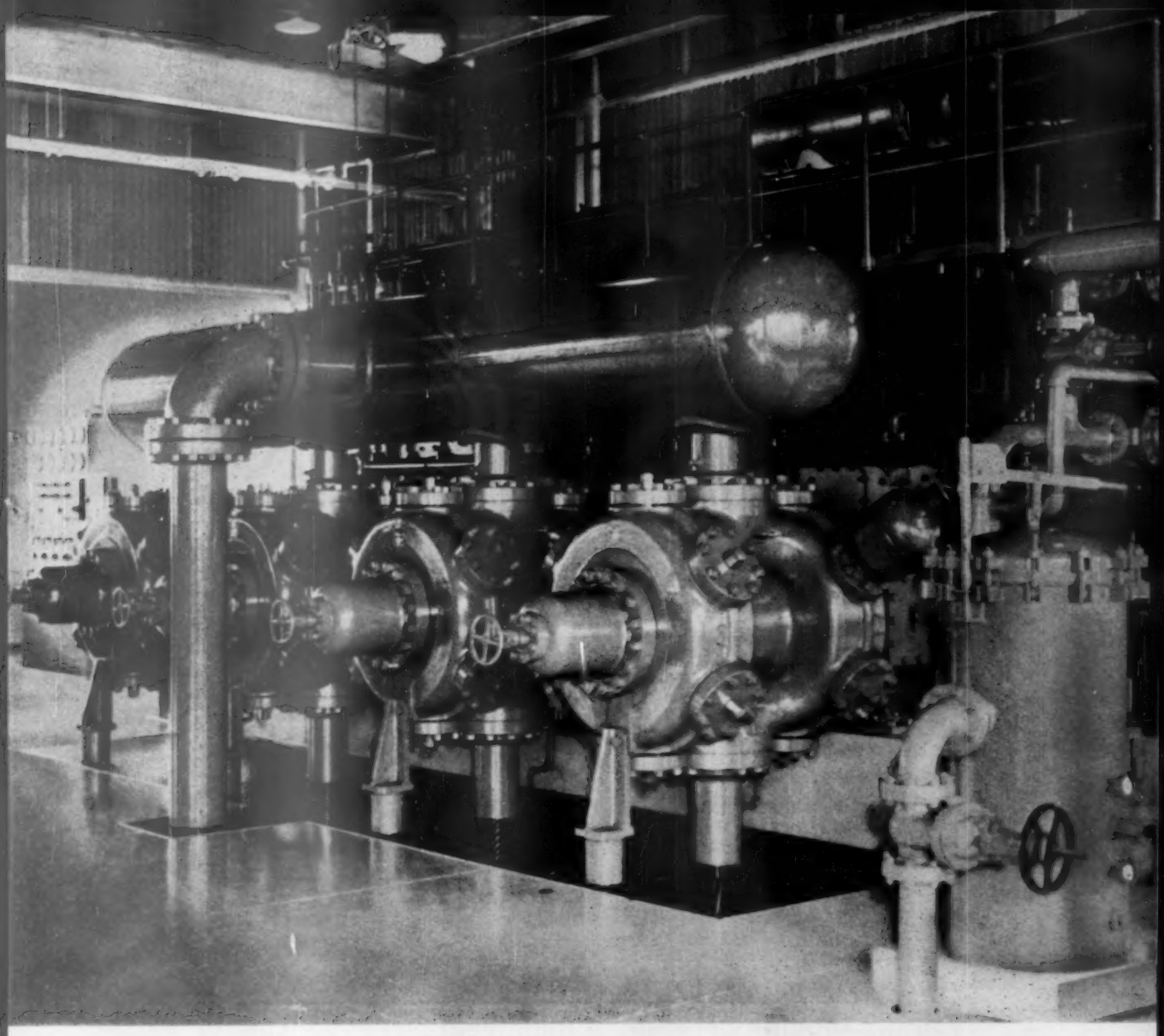
in the manufacture of Vogt Forged Steel Valves, Fittings, Flanges and Unions

ENGINEERED

by Vogt

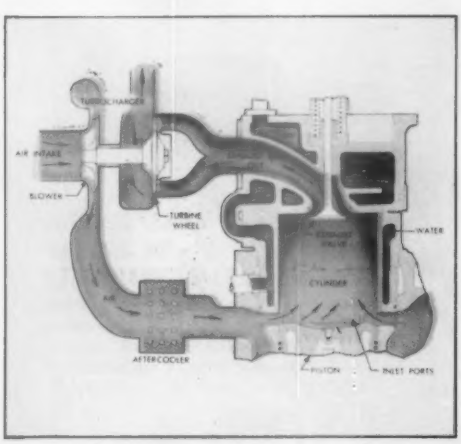
EXCELLENCE


Process Equipment
by CHIYODA
CHIYODA
CHEMICAL ENGINEERING &
CONSTRUCTION CO., LTD.
No. 3, MARUNOUCHI 2-CHOME, CHIYODA-KU, TOKYO, JAPAN. Cable Address "CHIYOTAKA, TOKYO"



At Northern Natural's Clifton Station, this SUTC engine compressor operates

20 HOURS A DAY...FOR 3 STRAIGHT YEARS



Self-sustained turbocharging at any speed and load is possible because of SUTC's exclusive Uniflo scavenging.

Five years ago a remarkable new engine compressor was introduced.

Called the SUTC, this Worthington turbocharged 2-cycle engine compressor was unlike any other. Combustion air enters thru side inlet ports, *but the exhaust is thru overhead valves.* Valve timing can be arranged to give maximum supercharging effect.

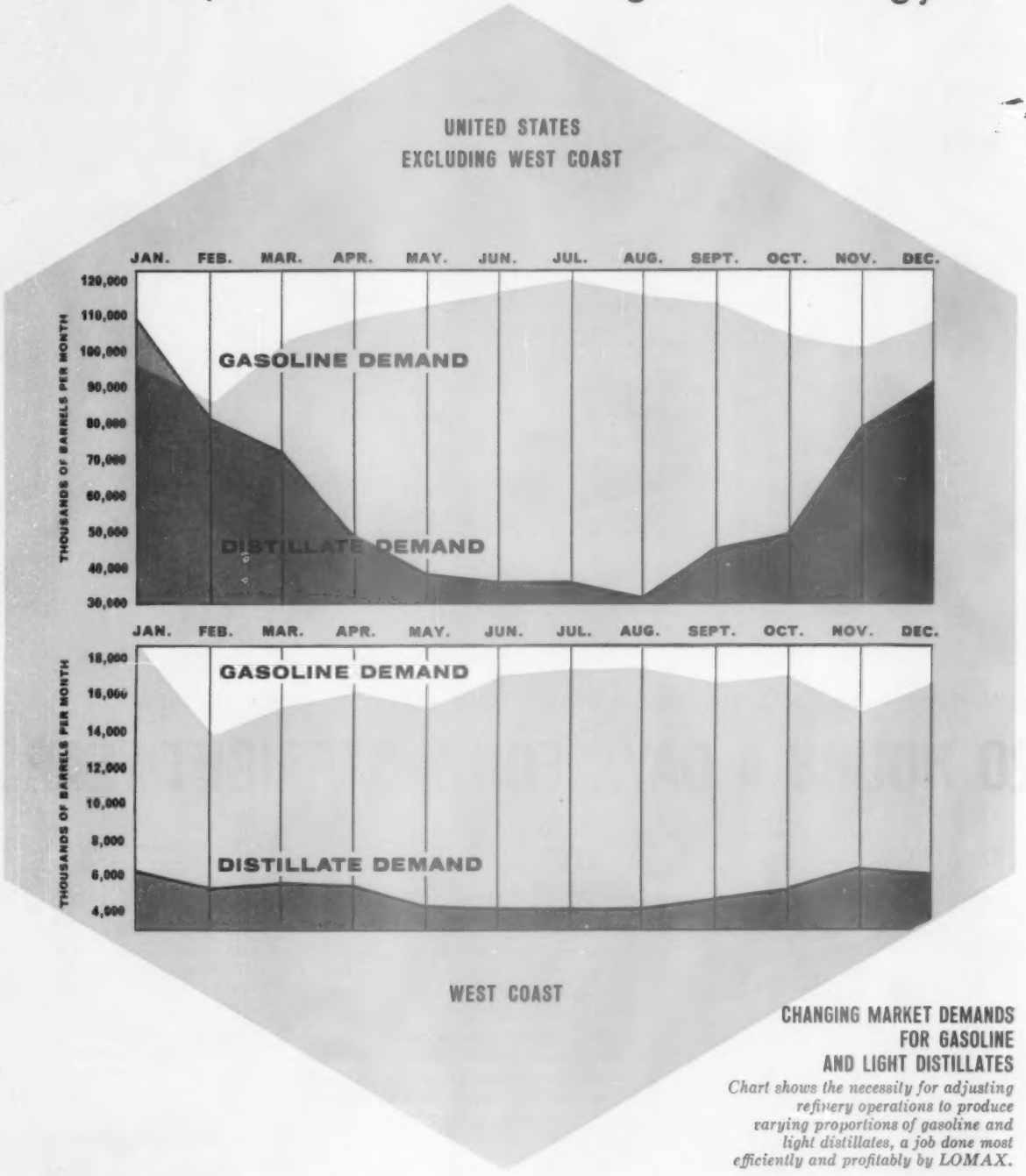
On paper, straight-thru or "Uniflo" scavenging has many advantages. The turbocharger operates over the entire speed and load range without help from external sources. Scavenging efficiency is increased and pulsations practically eliminated.

Now came the real test. More than 130,000 hp were installed. Operators praised the SUTC's exceptionally smooth, quiet operation. Operational records confirm the machines reliability. Unit G-2312 is typical. This 8 cylinder, 2000 hp SUTC engine compressor was installed in 1957 in Northern Natural Gas Company's Clifton, Kansas Station. To date, it has logged over 20,000 hours—an average of more than 20 hours a day for 3 straight years. A sister unit installed last year has equalled this performance.

May we send you complete data on this unique engine compressor? Please write to H. C. Barten, Worthington Corporation, P.O. Box 953, Buffalo 5, N.Y.

WORTHINGTON

now...**a major breakthrough** in petroleum refining technology...



CHANGING MARKET DEMANDS FOR GASOLINE AND LIGHT DISTILLATES

Chart shows the necessity for adjusting refinery operations to produce varying proportions of gasoline and light distillates, a job done most efficiently and profitably by LOMAX.

LOMAX

TRADEMARK

the versatile **new UOP** process

Here is a new and vastly important process to which every refiner should give serious consideration—now! Regardless of present markets and whether existing facilities are old or up-to-the-minute, LOMAX may prove economically attractive through *increased year-'round production of your most saleable products.*

Through the reaction of oil with hydrogen in the presence of a new UOP catalyst, LOMAX converts middle distillates, ranging from kerosines to heavy gas oils, into a wide ratio of gasoline or distillate fuels. This highly flexible process may be used to supplement existing facilities, or as a basic cracking operation in a new installation.

Advantages offered by LOMAX also include: Predominance of branched isomers in light hydrocarbons . . . greatly reduced quantities of light gases . . . olefin-free products . . . no catalyst deposit . . . distillates of exceptional high purity (even from sour crudes) . . . and other important benefits.

- **LOMAX** produces **maximum saleable product**...up to 120 barrels of product from 100 barrels of charge stock.
- **LOMAX** gives you **maximum production** of the product you want when you want it...whether gasoline or light distillates.

UOP®

Write for detailed technical information. Address:

UNIVERSAL OIL PRODUCTS COMPANY

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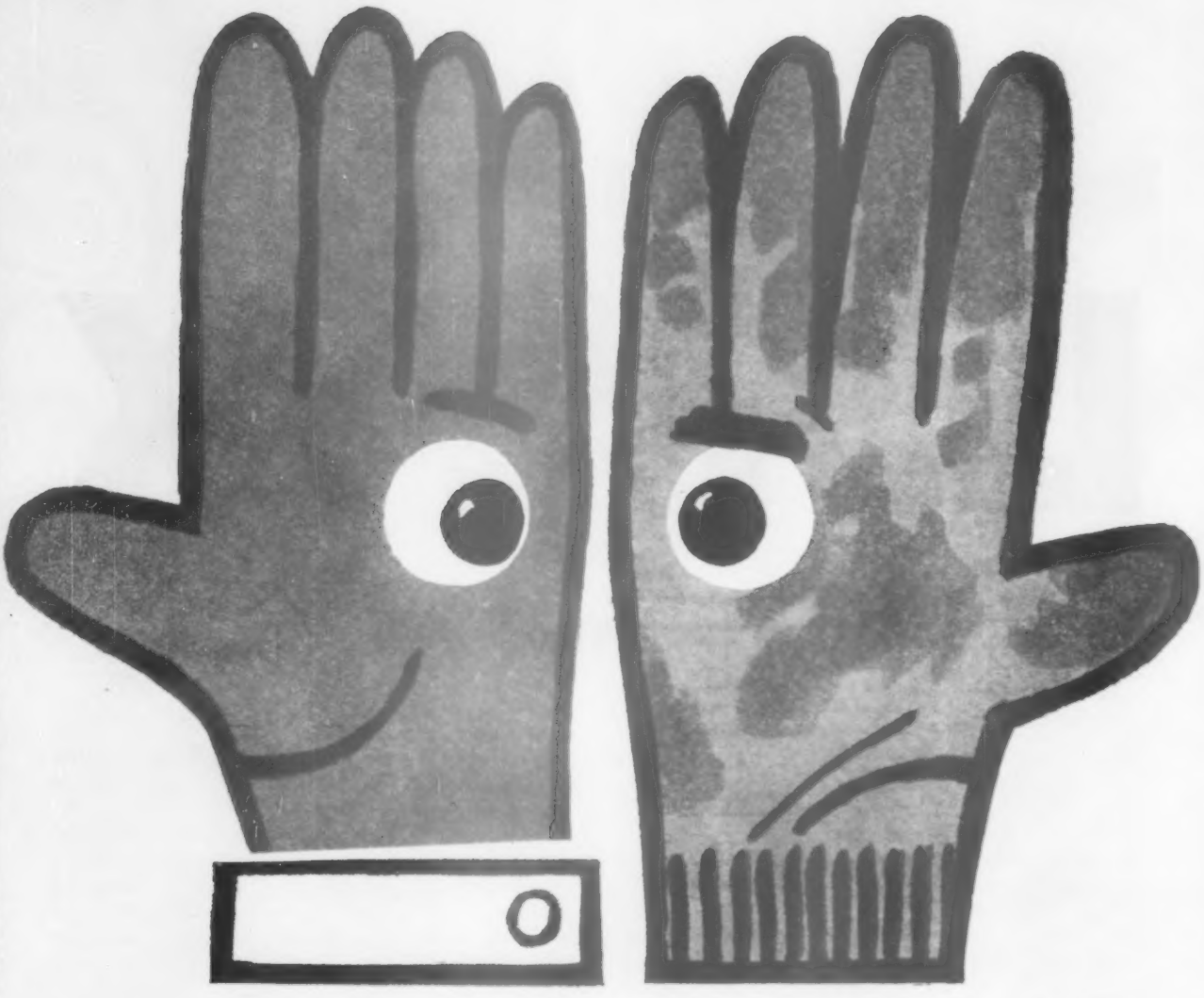
WHERE RESEARCH TODAY
MEANS PROGRESS TOMORROW



Does the right hand know what the left hand is buying?

Many times in mud buying the smiling left hand is happy because it is concerned only with the mud bill. And that can be kept low. But, a low mud bill often means low drilling efficiency. And that makes the right hand unhappy because it is concerned with keeping the *total* drilling operation efficient and economical.

An inadequate mud system can be responsible for a great deal of unnecessary expense in drilling an oil well. It can cause extra round trips, more bits. It can mean a slower rate of penetration, and time wasted in conditioning the mud. Poor mud can even damage the productive zone.

If these things happen on your wells with a fair degree of consistency, why not review the way "your hands" buy drilling mud. A well planned Magcobar mud program *may* cost a little more than a *cheap* mud program (although it will likely cost even less), but it can and will reduce your over-all drilling cost. It may even help you increase your production!

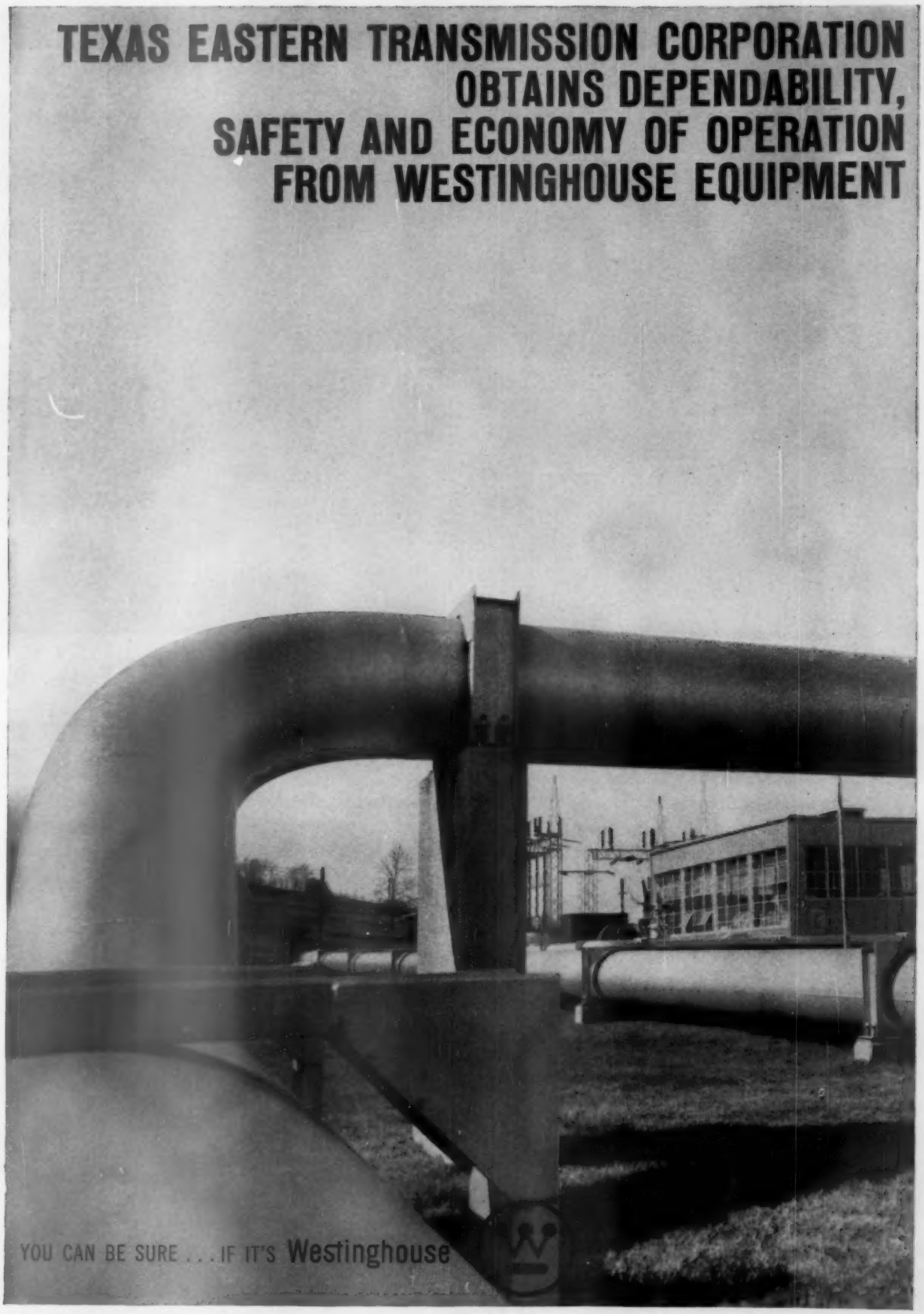
A *cheap* mud program may be the most expensive single item on your wells. A Magcobar planned mud program, on the other hand, assures the right use of the right products, makes full use of the money-saving advantages of Magcobar Technology. So, why not get all of your hands working towards the same objective? Let Magcobar plan with you to get the best wells at the lowest *total* cost.

Magcobar
Complete
DRILLING MUD SERVICE

DRESSER INDUSTRIES, INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

WELL DONE WITH MAGCOBAR TECHNOLOGY • MAGNET COVE BARIUM CORPORATION

TEXAS EASTERN TRANSMISSION CORPORATION OBTAINS DEPENDABILITY, SAFETY AND ECONOMY OF OPERATION FROM WESTINGHOUSE EQUIPMENT



WESTINGHOUSE EQUIPMENT KEEPS MT. PLEASANT

Texas Eastern's Mt. Pleasant station maintains a constant pressure of more than 900 psi on a pair of 30" pipelines to move gas some 60 miles to Gladeville, Tennessee. It forms a link in a pipeline system stretching from the Mexican border to Linden, New Jersey.

Westinghouse equipment was installed in this natural gas pumping station when it was constructed four years ago. "When the station was recently expanded to double its capacity, Westinghouse equipment was specified again. It has given dependable, safe service," asserts E. E. Blankenship, Station Chief.

The two Westinghouse transformers receive bulk power at 161,000 volts and reduce it to 4160 volts for direct utilization by a pair of 15,000-hp Westinghouse motors which supply the main power for the station's two huge compressors. The 900-rpm synchronous motors are coupled to speed increasers that step up the operating speed to 6500 rpm.

Two 225-kva transformers, also located in the main switchyard, supply the station's auxiliary system with 480 volts for blower fans, lube and seal pumps, lighting and the main control system. Stand-by pumps, to take over during a shutdown of one of the larger motors, are also supplied by the distribution circuit.

Centralized direction of the pumping station equipment is handled from the Westinghouse Control Console. A built-in safety system prevents compressor operation if oil temperature and pressure are not at a proper operating level.

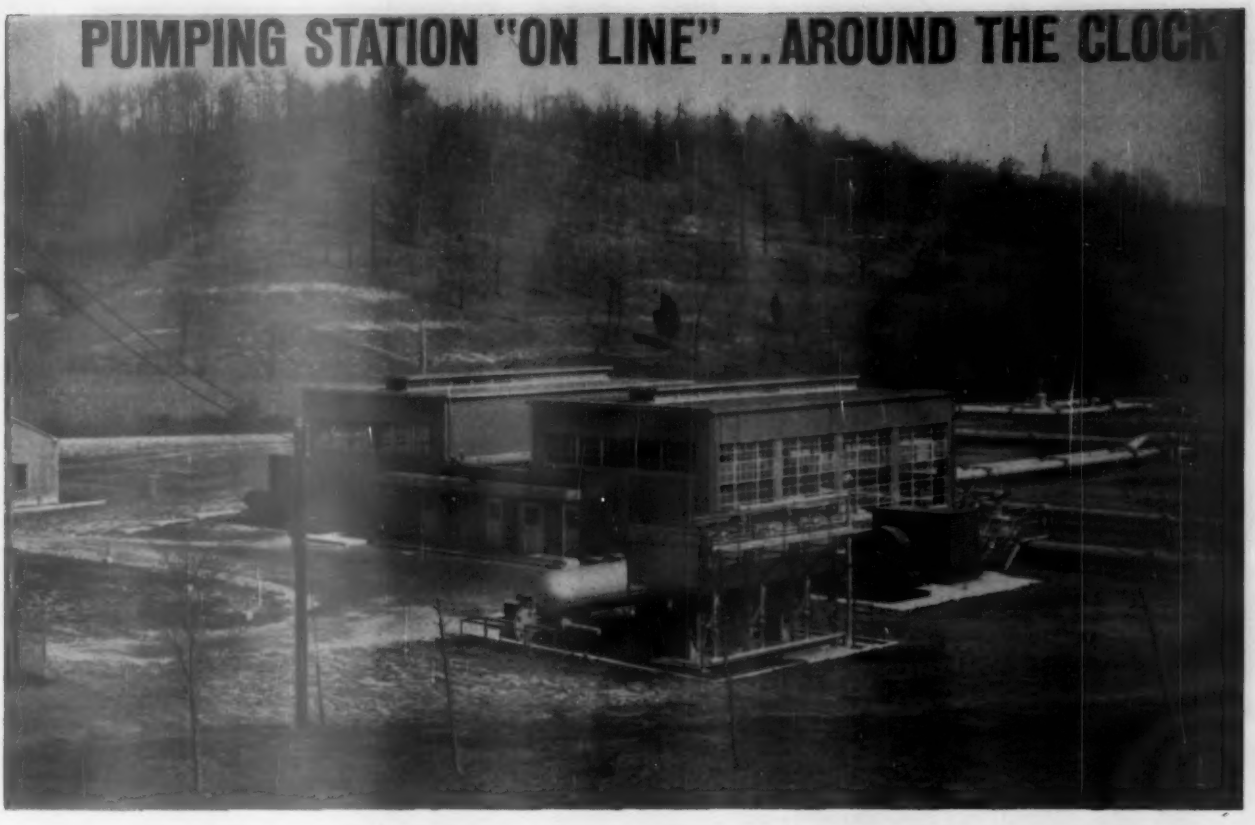
Automatic sequence control systems form a sound basis for a new concept initiated by Westinghouse to help pipeline operators gain increased system efficiency while holding costs to a minimum. *Progressive Automation* is a long-term, step-by-step plan leading to economical automatic operation. Your nearby Westinghouse representative is ready now to help you formulate your individual *Progressive Automation* plan. Contact him today . . . or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

Westinghouse

(*continued*)

J-96150-2

PUMPING STATION "ON LINE"...AROUND THE CLOCK



EXCITER UNIT in the foreground excites the Westinghouse 15,000-hp main drive motor at one side of the Mt. Pleasant pumping station. E. E. Blankenship inspects the Westinghouse synchronous motor which is directly coupled to the gear unit to increase output from 900 to 6500 rpm. Equipment is duplicated for the second pumping unit.

ALL MOTOR CONTROL DEVICES are contained in this compact Westinghouse Control Center. Centralized location permits operators to quickly spot electrical faults. Front accessible cubicles speed inspection or repairs. Unit also contains instrumentation panel and relays to automatically regulate drive motors and compressor.

A SINGLE PUSHBUTTON on the operator's console initiates the automatic compressor start-up. A train of relays automatically sequence the pickup of station equipment step by step . . . while continually monitoring the pressures, speeds and other relevant factors. Approximately 10 to 12 minutes elapse before the station goes on line.

J-96150-3

ELECTRICAL SYSTEM CONTROL is provided by the Westinghouse outdoor, metal-clad switchgear. Type DH horizontal drawout air circuit breakers in these cubicles protect the station transformers against possible faults on the secondary distribution system. Here Station Chief E. E. Blankenship checks the voltage level on the instrument panel. Cubicle also contains relays and metering equipment.

TEXAS EASTERN TRANSMISSION CORPORATION SPECIFIES WESTINGHOUSE (*continued*)

Main power for station is received at the substation switchyard. Westinghouse supplied the complete station, including the standardized overhead structure. Bulk power at 161,000 volts is received from the electric utility. Power circuit breakers and lightning arresters protect the transformers against faults on the utility line. The Westinghouse transformers reduce the voltage to 4160 volts to supply the 15,000-hp drive motors.

J-96150-4

Westinghouse

PROTECTION AGAINST ACCUMULATING GAS within the main drive motor enclosure—and motor cooling—is provided by the separately mounted, motor-driven blower. This maintains the operating temperature level of the main rotating apparatus at a point that virtually eliminates the possibility of spontaneous combustion.

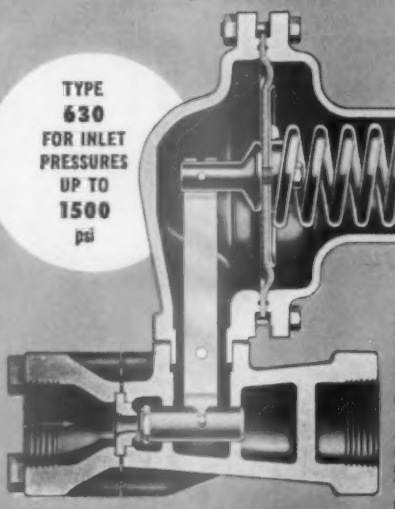
CIRCUIT ISOLATION is provided by the 161-kv power circuit breaker so that the electrical equipment can be inspected or switchyard maintenance performed. After interrupting power to the station, the overhead switches can be operated from the ground to isolate either of the substation transformers and the electrical circuit beyond each unit. The self-supporting lightning protectors are insurance against a direct strike on the substation.

Your **FISHER/MAN** Brings You

FISHER PRESSURE REGULATORS

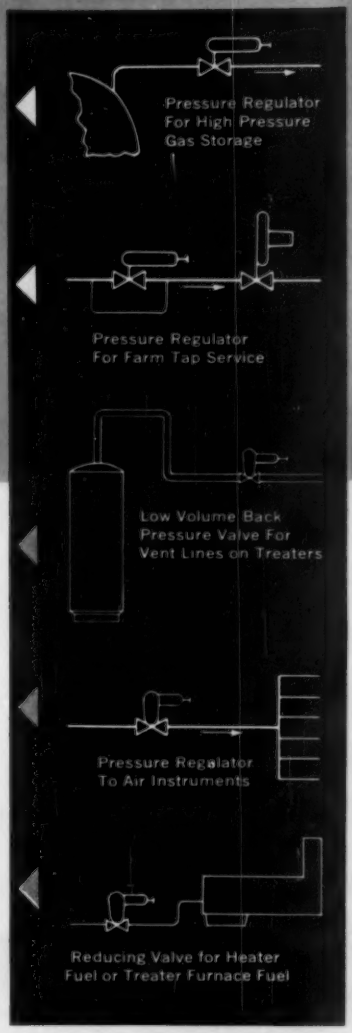
- Built for rugged, high pressure jobs
- Designed for dollar saving installations

TYPE 630 FOR INLET PRESSURES UP TO 1500 psi



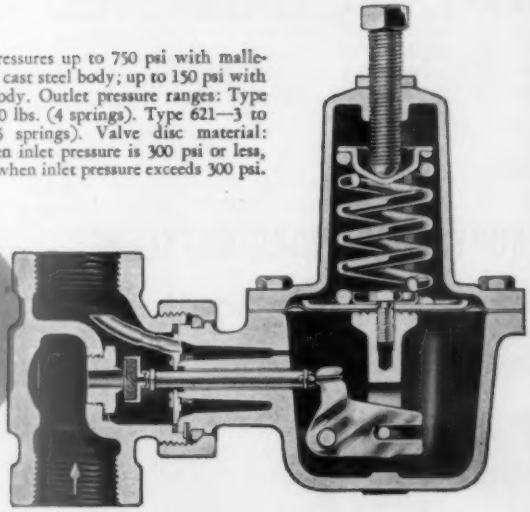
BIG JOE Type 630. Reduces high pressure gas to a constant supply pressure of 5 to 200 psi. Valve disc material: Up to 200 psi inlet BunaN is furnished. 200 psi inlet and above, Nylon is furnished. (Teflon is available when specified.)

Big Joe is supplied in 1" or 2" screwed connections. Type 630 can also be furnished as a relief valve, Type 630R for relief pressures up to 175 psi.


Pressure Regulator For High Pressure Gas Storage
Pressure Regulator For Farm Tap Service
Low Volume Back Pressure Valve For Vent Lines on Treaters
Pressure Regulator To Air Instruments
Reducing Valve for Heater Fuel or Treater Furnace Fuel

For inlet pressures up to 750 psi with malleable iron or cast steel body; up to 150 psi with cast iron body. Outlet pressure ranges: Type 620—3 to 60 lbs. (4 springs). Type 621—3 to 100 lbs. (5 springs). Valve disc material: BunaN when inlet pressure is 300 psi or less, and Nylon when inlet pressure exceeds 300 psi.

TYPE 620 FOR INLET PRESSURES UP TO 750 psi



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SINCE 1880

YOUR REFINERY WILL YIELD MORE WITH CYANAMID'S FLUID CRACKING CATALYST COMPOSITION

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THREE COMPONENT CATALYST

MORE GASOLINE OR MORE PROPYLENES, MORE BUTYLENES Cyanamid, in co-operation with a major oil company, has developed AEROCAT 3C—a new fluid cracking catalyst composition. AEROCAT 3C gives refiners more flexible and profitable operations and a greater yield at the expense of dry gas and coke. AEROCAT 3C-12 for increased gasoline yield. AEROCAT 3C-20 for increased propylene and butylene yields. **BASIC IN CATALYST CHEMISTRY**

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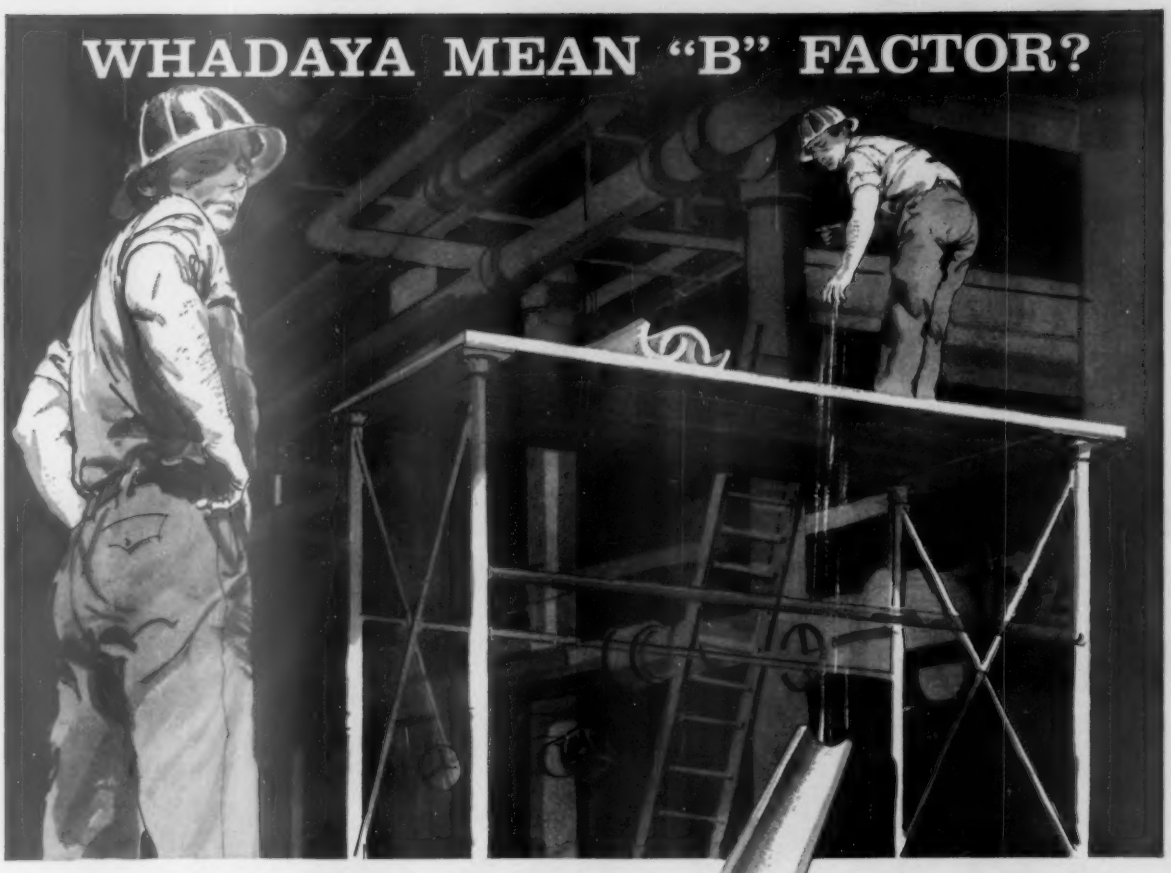


Use Unibestos, the rugged insulation

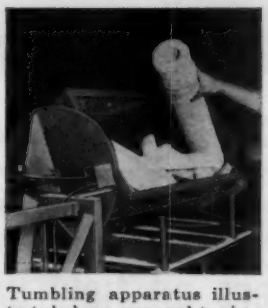
"B" is for Breakage . . . one of the most important cost factors on any insulation job. When you load for shipment, unload for warehouse, reload for job site, then unload and spot for installation, it takes a *rugged* insulation to get there with *no breakage.* And that's just what Unibestos will do for you. And how "B" factor saves cleanup time, too. No wonder 15% to 20% savings is not unusual.

That's also one of the reasons why Unibestos is worth more. Yet it continues to sell at competitive prices.

Hit it, drop it, ship it in ordinary cardboard cartons without packing and you still come up with tough, efficient insulation sections. Unibestos eliminates breakage and shrinkage; defies thermal shock, fumes, acids and moisture; cuts application time and costs; and guarantees real insulating efficiency.

Available in a full range of standard pipe sizes and in block form. Single thicknesses up to five inches. Specials to 44" O.D. in half sections.

Write today, on your letterhead, for Bulletin No. 65610.



Tumbling apparatus illustrated above was used to simulate jars incurred in LCL shipments. After 29.2 minutes (204 revolutions) Magnesia insulation is completely broken down. Unibestos remains O.K. for installation because of its exclusive long-fibered *Amosite* asbestos.

UNIBESTOS

worth more, yet sold at competitive prices

UNARCO®

UNARCO PRODUCTS

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oil field motors

Only R&M builds "ALL-WEATHER®" MOTORS!

"All-Weather" is a registered trademark for Robbins & Myers oil field motors! This means that only from R&M can you get this exclusive, fully-protected motor design which assures dependable, long-life service under all environmental conditions: wind-driven rain, dampness, corrosive atmospheres, hazardous condensation, dust and dirt. Write today for your copy of R&M's "All-Weather" motor bulletin 520-0G

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Subsidiary companies at Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

OIL HOLES FOR LONGEST WEAR LIFE

Effective penetration of lubricant into the working parts of an oil field roller chain is vital for long wear life. In Rex Oil Field Roller Chains this *plus* value is assured because every chain in the line has scientifically designed and sized oil holes in the bushings to provide easy distribution of lubricant to the points where it's needed.

This feature and the correctly designed built-in clearances enable the lubricant to protect the chain against premature failures due to wear and "galling" of parts. For longest wear life ...highest fatigue strength, get the chains that give you ALL the *plus* values: Rex Roller Chains. Available in GLIDE-FIT (cottered) and DRIVE-FIT (riveted) styles. CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

Get ALL the Plus Values

- Pitch control
- Guide-pierced and ball-swaged link plates
- Built-in beneficial stresses
- Positioned seam bushings
- Oil holes for effective lubrication
- Gap-free round rollers
- Roll pin fasteners...proved best

For Highest Fatigue Strength ...Longest Wear Life

REX® OIL FIELD ROLLER CHAINS

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What makes **TRANSCOPE®**

Electronic and Pneumatic Recorders

the most wanted miniature instruments on the market today?

. . . *The answer is* **SERVO**

In the past 2 years thousands of Servomatic motors have proven the inherent advantages of this Taylor innovation. Heart of the 90J (pneumatic) and 700J (electronic) recorders, it puts TRANSCOPE Recorders in a class by themselves. It is the most reliable device yet developed for converting an input signal into an accurate record. The tremendous power of these Servomatic motors—150 times greater than the bellows type (pneumatic), over 1,000 times greater than galvanometer systems (electronic)—gives you all these advantages:

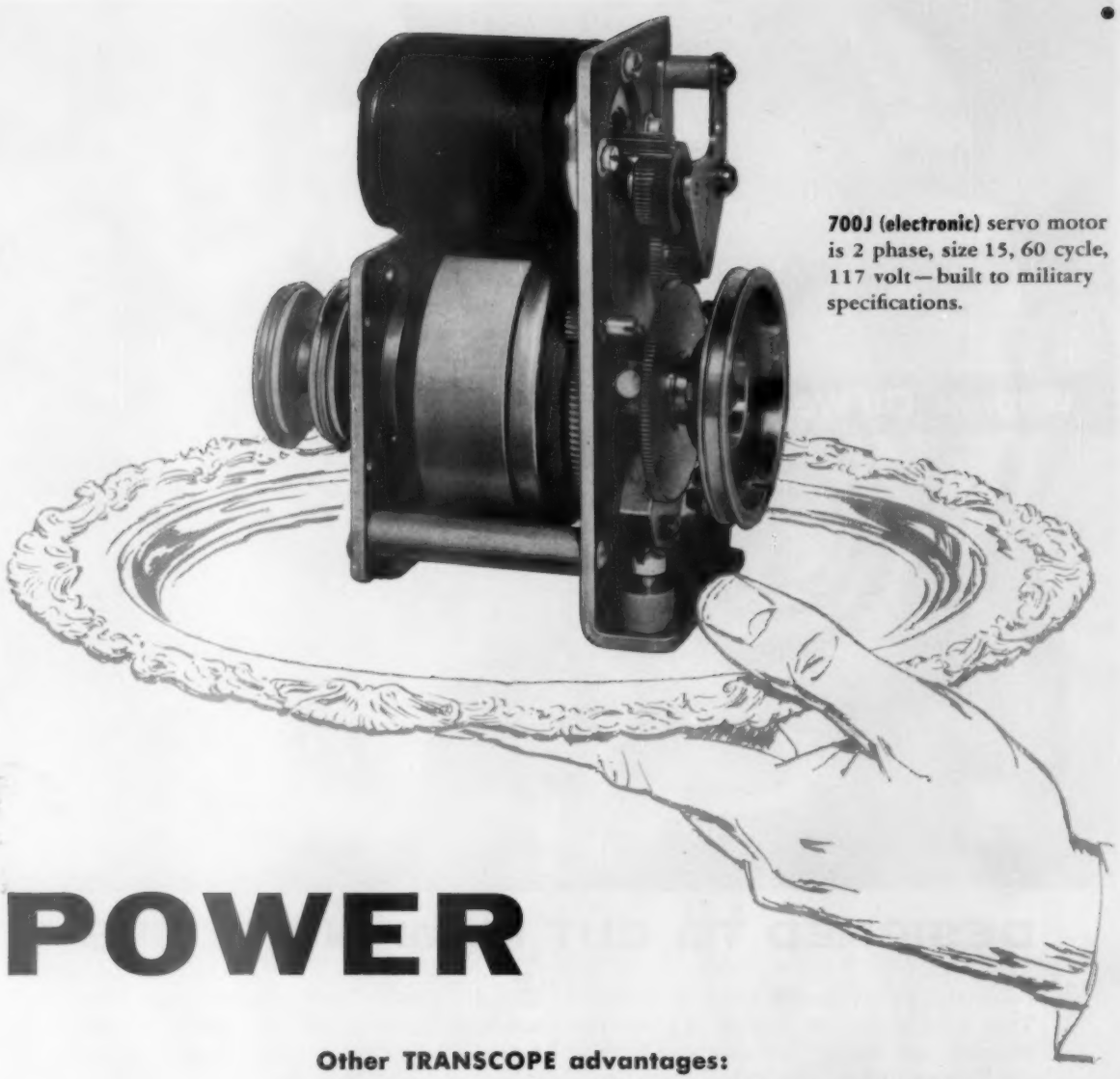
- Greater accuracy than ever before—½ of 1% in standard instruments, ¼ of 1% optional.
- Threshold sensitivity of 0.1% to input signal.
- 3 months' ink supply mounted on the pen—no troublesome capillary.
- Lifetime recording accuracy—no critical pen pressure.
- No flimsy linkages and levers.
- Truly rectilinear chart—no curved time lines.

Plus these optional features: alarm contacts—retransmitting potentiometer—function generation—digital output with encoder discs.

* * *

Ask your Taylor Field Engineer for full details of all the many superior features of TRANSCOPE servo-operated recorders. Or write for Bulletin 98286 (pneumatic) or 98335 (electronic). Taylor Instrument Companies, Rochester, New York, or Toronto, Ontario.

See it demonstrated at the ISA Show, Booths 1432-36; 1531-35



700J (electronic) servo motor is 2 phase, size 15, 60 cycle, 117 volt—built to military specifications.

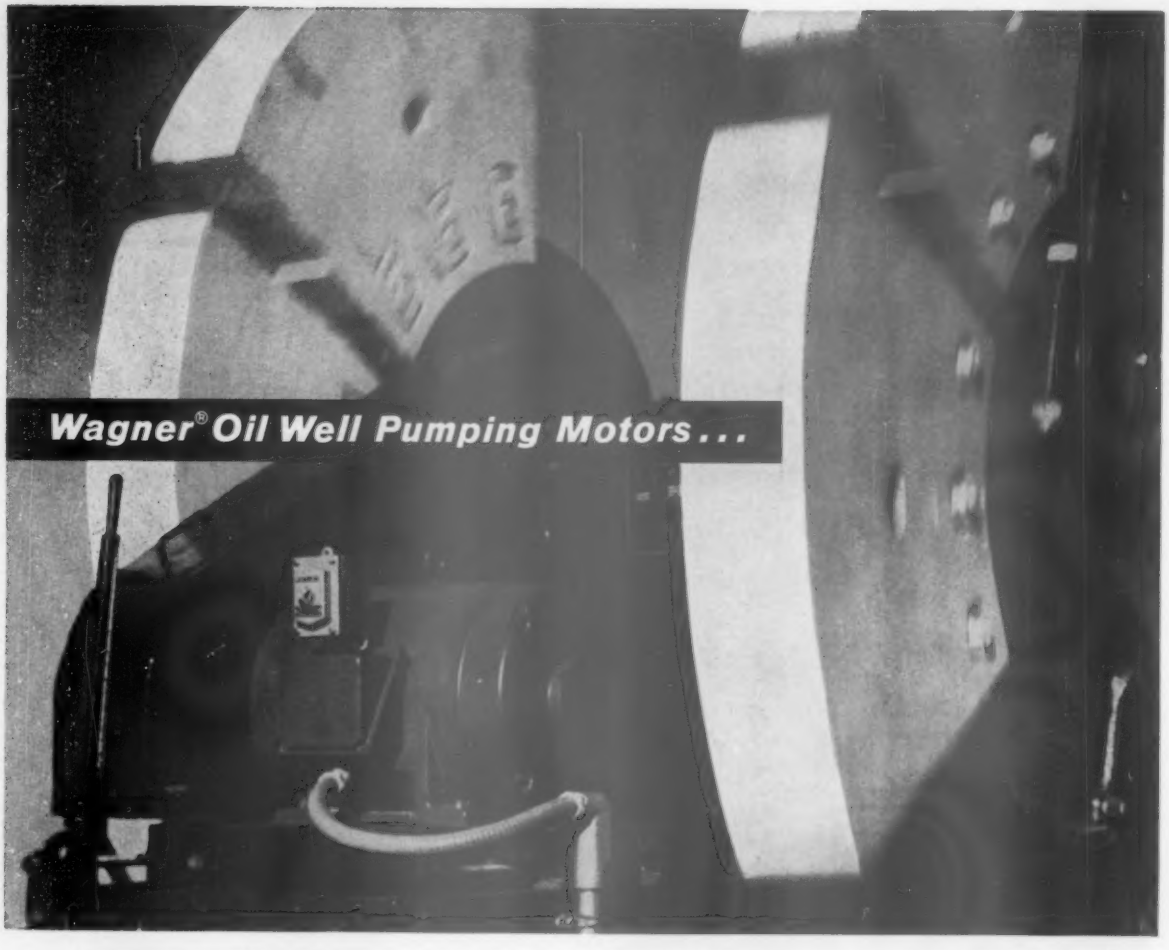
POWER

Other TRANSCOPE advantages:

- Unconfused readability—because chart record, pen and set-point are side-by-side.
- 4" chart reads from left to right—on rectilinear coordinates.
- Controller response adjustments may be made from the front—you can watch the results.
- Separate Plug-in Set Point Transmitters permit staying on automatic control—even when recorder slide is removed.
- All principal assemblies are plug-in mounted for flexibility and accessibility.
- Plug-in recorders and controllers permit housings to be shipped 4-6 weeks earlier than completed instruments to enable you to make all necessary connections to tagged manifolds.

Recorders of the future will have SERVO POWER . . . TAYLOR has it NOW!

Taylor Instruments **MEAN ACCURACY FIRST**



DESIGNED TO CUT PUMPING COSTS

Positively. For Wagner® Class B insulated Type DP-6 Motors are engineered for oil well pumping, *and only oil well pumping.* Nothing else. Because they are designed with high torque and high slip for this specific job, these motors consume fewer kilowatts per barrel pumped . . . give you double dollar savings (in initial investment and in operating costs) without sacrificing efficiency and dependability.

Consider this: built in ratings of 5 hp and larger, these high torque motors handle heavy initial loads smoothly and without laboring or stalling. Their high slip feature lets them slow down at peak load so the flywheel of the pump can deliver part of its stored energy to the load. Motor windings are protected by advanced Class B insulation which provides ample thermal capacity to absorb heat resulting from peaks of the cyclic load. Completely dripproof enclosures protect them against rain, sand, sleet and snow. Rugged cast iron frames and endplates bar corrosion. Conduit boxes are moisture-proof and dust-tight, and ventilating openings are screened to keep out animals and wind-blown debris. You pump *better* electrically with Wagner Motors.

Your Wagner field engineer can give you the complete story, and help you plan oil well pumping, gathering and water-flooding systems . . . assist you in solving your electrical problems. Call him now, or write for Bulletins MU-243 and MU-246.

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. . . engineered to stay on line longer!

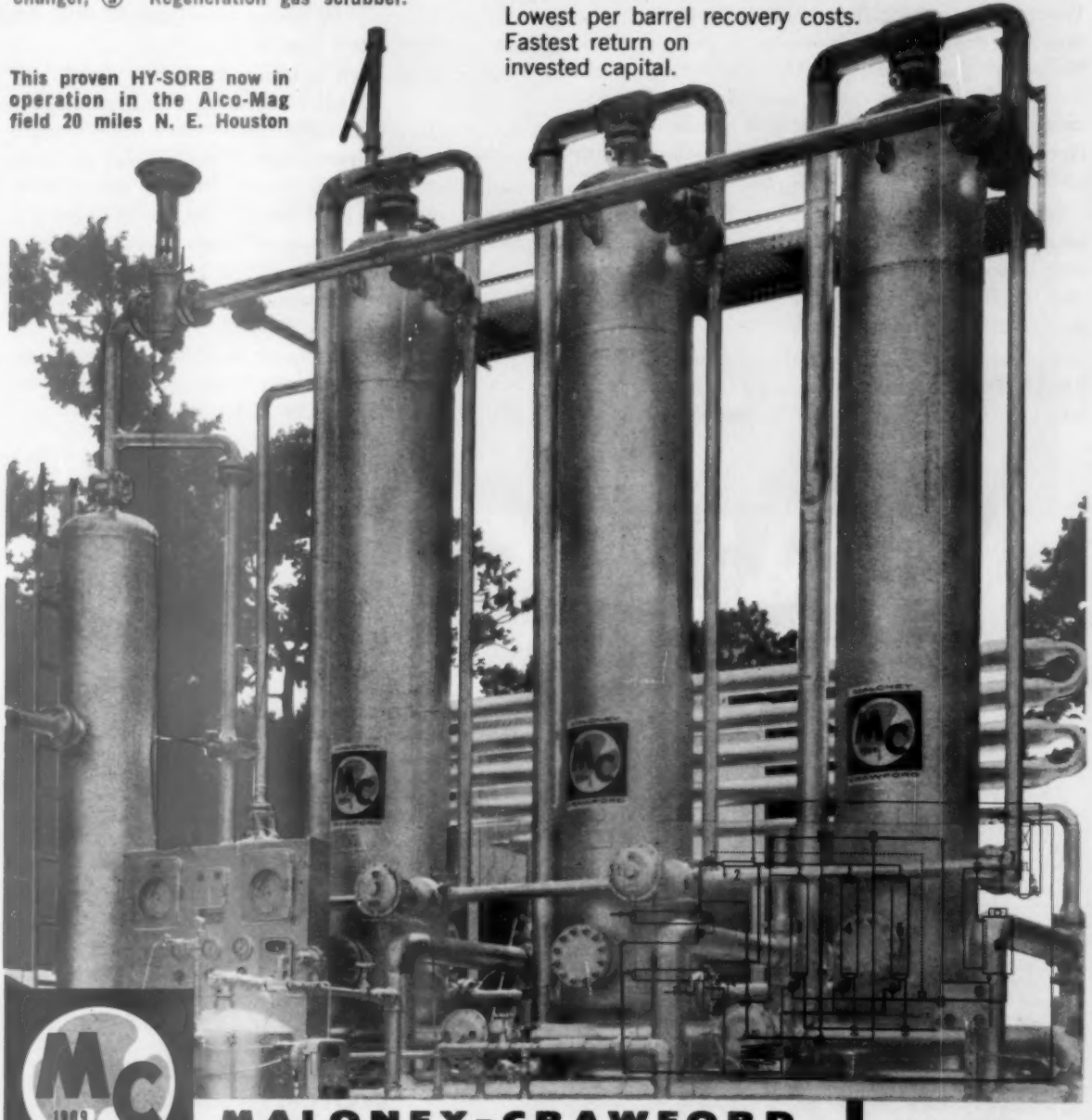
New, three tower dry-bed recovery unit can pay out in less than a year. Three tower method splits the work-load three ways — adsorption, heating, cooling — each stage at peak efficiency because each tower does only one job at a time.

KEY TO COMPONENTS: ① Inlet scrubber ② Products cooler, ③ ④ ⑤ towers (No. 3, shown on stream), ⑥ Salt bath heater, ⑦ Auto-reflux stabilizer, ⑧ Atmospheric heat exchanger, ⑨ Regeneration gas scrubber.

HY-SORB three tower method eliminates hot pumps, motors, seals and bearings. Simplicity of controls; smaller, more efficient towers; and basic balanced design, cut down-time and maintenance costs.

Lowest per barrel recovery costs.
Fastest return on
invested capital.

This proven HY-SORB now in operation in the Alco-Mag field 20 miles N. E. Houston



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Write for Bulletin
No. HS- 60- A

HAVE YOU TAKEN SIDES IN THE BELT DRIVE REVOLUTION?

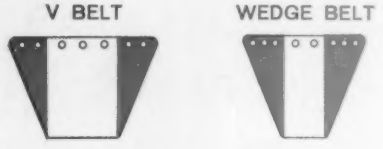
The change from Multi-V to Multi-Wedge is revolutionizing belt drives. A simple change in shape gives the Wedge Belt greater efficiency. Thus the number of belts can be less, diameters can be reduced 30 to 50% and center distances cut 20% for the same transmitted horsepower. In fact, Multi-Wedge drives result in initial savings up to 20%.

Because of this potential saving, it's to industry's advantage to design Wedge-Belts into new equipment as soon as convenient. But Worthington will supply complete requirements in both Multi-V and Multi-Wedge drives until the latter has completely taken over.

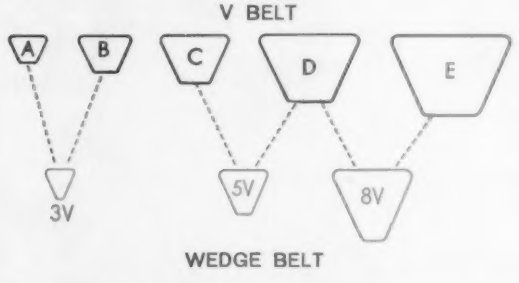
Are you worried about interchangeability of brands? Frankly, five out of the eight leading drive manufacturers now offer Multi-Wedge, as well as the Multi-V drives. And so far, all Multi-Wedge drives are offered in the same belt and sheave sizes.

There is, however, an important reason for preferring the Worthington Multi-Wedge drive. Worthington makes the QD (Quick Detachable) sheave—the industry's largest seller—in the complete range of Multi-Wedge standardized dimensions. This sheave, with its two Golden Screws, appeals to plant operators because of its positive locking arrangement—easy on . . . easy off . . . always tight.

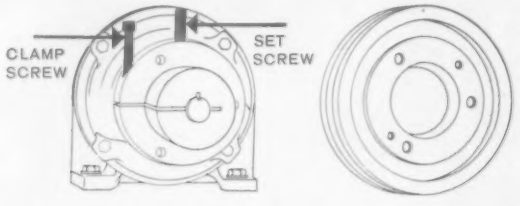
For Multi-Wedge drives, Worthington maintains a large stock of its QD sheaves and Worthington-Goodyear Wedge belts from coast to coast. For information call your Worthington distributor listed in the yellow pages of your phone book. Or write Worthington Corporation, Section 79-28, Oil City, Pennsylvania.



The cord layer near the top of either belt carries the load. This layer is, however, only efficient in the portion supported by side walls (red areas). Because more of its top section is over the side walls, the Wedge belt is more efficient than a V belt.



Because the smaller Wedge belt does more work, the number of sizes have been reduced without loss of flexibility. The new Wedge belts are available in three standard sections: 3V, 5V and 8V. Stock 3V and 5V sheaves cover horsepower ranges through 200 hp. Made to order 8V sheaves will be used for 200 to 2,000 hp. requirements.



Worthington QD sheaves are preferable for Multi-Wedge drives. The clamp screw simplifies installation, assures permanent alignment, and makes it possible to use a set screw without causing hub distortion that might cause eccentric runout. The set screw prevents "key drift" by locking the key securely in place. You install QD sheaves easily—one part at a time. If change in speed is required, you simply install another sheave on the hub which remains anchored to the shaft.

WORTHINGTON

DU PONT Petroleum Chemicals NEWS

Number 104 in a series of bulletins for the Petroleum Industry

SEPTEMBER • OCTOBER 1960

Foam killer finds new uses in gas scrubbing

The primary use of DuPont's OCENOL® anti-foaming agent in the petroleum industry has been as a foam-breaker in the Girbotol process.

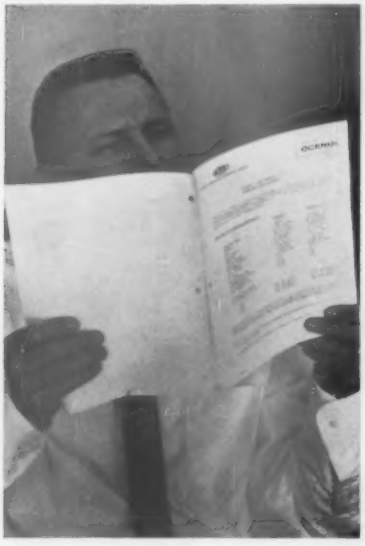
Now OCENOL is finding increasing use in atmospheric and vacuum distillation processes. Full-scale use in several such operations indicates that it is one of the most effective anti-foam agents available for the job.

And it has cost-saving advantages, too. OCENOL carries a low price tag, works effectively in concentrations of 0.1 to 0.3 lb. per 1,000 barrels. The result is that on a performance basis you pay a very low price to break foam with OCENOL.

What OCENOL is

OCENOL is a technical grade of oleyl alcohol rich in cetyl and unsaturated C_{18} alcohols. It is available in two forms: OCENOL and OCENOL P. OCENOL P contains a lower proportion of unsaturates than OCENOL. In some applications, the products can be used interchangeably.

OCENOL may be the answer to your foaming problem. Write direct to Wilmington for technical data, or contact your DuPont Petroleum Chemicals representative.



How to stop paying for sludge in distillate and residual fuels

One shovelful of sludge. Looks like so little. *Yet you pay for it three times* in the marketing of a distillate and residual fuel.

You pay for downtime and labor when storage tanks must be desludged. You pay for lost product. You pay for excessive filter and strainer replacement, or for handling complaints from customers who have these problems.

This is money you do not have to spend. Care in handling, in the blending of fuels and in the use of proper additives will save you this money. To overcome sludge, add DuPont Fuel Oil Additive No. 2 to your product. For every 1,000 barrels of residual or diesel fuel, you need only a small amount of DuPont FOA-2 — usually 5 to 15 pounds. This stabilizes, solubilizes, disperses and keeps insoluble particles in suspension so they won't form residue.

You get just as much burnable fuel *out* of the storage tank as you put *in*, with nothing lost to sludge.

Customer Benefits. In diesel fuels, FOA-2 eliminates or greatly reduces filter plugging and injector sticking. One user reported that filter life doubled on heavy roadbuilding equipment with subsequent savings in labor, downtime and filter replacement.

Being nonmetallic, FOA-2 burns right along with the fuel, leaves no ash or other deposit. Does not contribute to sparking problems.

In residual fuels, FOA-2 prevents or reduces tank sludging, burner fouling, and strainer and heat exchanger clogging.

The Science of Sludge. The petroleum industry has used DuPont FOA-2 in millions of barrels of diesel and residual fuel since its introduction nine years ago. At DuPont, sludge formation, prevention and removal has become a science, and our experience is available to help you improve the flow and burning properties of your product. Call or write for our bulletin on FOA-2, or for consultation on sludge prevention.

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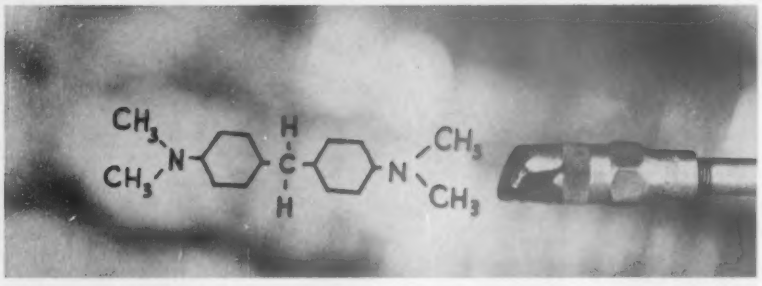
OVER

DUPONT *Petroleum Chemicals* NEWS

New way to stabilize your grease and oils



Oxidation is, of course, one of the bitterest enemies of the grease and oil you produce.

The problem looks simple on the surface: use an antioxidant.

But what complicates it is *cost*. Profit margins don't permit you to pay so much money for additives that your product ends up with a price tag that's out of line with competition.

Answer from Du Pont

Now there's a way out of this problem. Currently available is a Du Pont antioxidant that effectively stabilizes greases and lubricating oils, protects them from oxidation, *yet is used in small concentrations.*

Called ORTHOLEUM 304, this product is an antioxidant with one of those jawbreaking chemical names you like to roll around on your tongue: 4, 4' tetramethyldiamino-diphenylmethane.

ORTHOLEUM 304 is a light grayish granular solid, with excellent storage stability. Melting point: 190°F. Bulk density: approx. 5 lb./gal. Supplied in 47-gallon fiber drums containing 200 pounds net.

Samples available

If you want smooth, uniform texture, even when your grease or oil has been stored for a time, look into the economy of ORTHOLEUM 304. The broad uses of this antioxidant are illustrated by 17 references contained in our literature. Ask your Du Pont Petroleum Chemicals Division representative for details and a sample, or write direct to Wilmington, Delaware.

CHICAGO DISTRICT MANAGER

JAMES M. MOSTYN is manager of the Chicago District, Du Pont Petroleum Chemicals Division.

Prior to joining Du Pont in 1948, Jim worked in the petroleum additives field for several years. During his service with the Corps of Engineers of the U. S. Army, he was assigned to various duties in North Africa, Italy, and France, for which he received four battle stars and a Bronze Star.

His first assignment with Du Pont was in the Central Region Laboratory of the Petroleum Chemicals Division. By 1958 he had become manager of the Chicago District office.

His work with Du Pont's Petroleum Chemicals Division has covered laboratory, safety, construction and sales, which explains why Jim is especially qualified to give technical help to users of Du Pont tetraethyl lead and our other petroleum additives.

A native son, Jim lives today in the same town in which he was born, Summit, Illinois. At home his life centers around (a) his wife, Lorraine, three daughters and two sons, (b) his golf clubs and (c) his fine pipe collection. Next time you're passing by 8 South Michigan Avenue in Chicago, stop in for a chat. You choose the subject . . . petroleum, putts, pipes or potpourri.

Heard about Du Pont's new "hush hush" dye?

Du Pont's new Oil Color IA has been created to identify products which, for various reasons, you choose not to give a distinctive color.

It's an undercover dye, an identifying agent (IA). Though it adds no appreciable color to your product, you can easily detect its presence by simple tests.

For example, a few drops of gasoline or kerosine containing 0.5 to 1.5 grams of Du Pont Oil Color IA per 100 gallons will immediately produce a blue spot on a paper towel.

Smaller concentrations — as little as 0.03 grams per 100 gallons — can be detected by shaking the gasoline with a little methanol and acid water and observing the color of the methanol layer.

Purpose? You can solve many special problems with this unusual dye, including: coding products to determine source, brand or grade; identifying gasolines for tax purposes; controlling proper use of products; deterring pilferage.

Ask your Petroleum Chemicals representative for more information.

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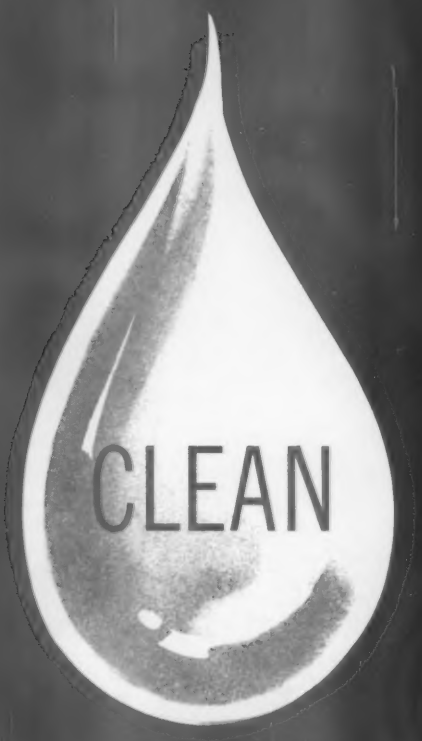

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The problem is to treat effluent or produced water so that it will be harmless to equipment, underground formations, and wildlife and watersheds—a problem made tougher by the fact that no two water treating problems are alike.

Flexibility and adaptability of BS&B's extensive line of Aqua-Kleener units enable you to match up a variety of solutions with the variety of water treating problems encountered, from an installation composed of a single filter and storage tank to complete open and closed systems.

THE BS&B AQUA-KLEENER LINE:

Treaters, Oil Skimmers, Free Water Knockout Tanks, Backwash Tanks, Filters, Filta Wash Tanks, Phanto-Matic Backwash Controllers (for automatic filtering), Aerator/Degasifiers, Raw Water Treating Tanks, Bolted Steel, Welded Steel, Wood or Poxyglas Storage Tanks.

Ask your local representative for full information or write to BS&B, Dept. 1-A9A, P. O. Box 1714, Oklahoma City, Okla.

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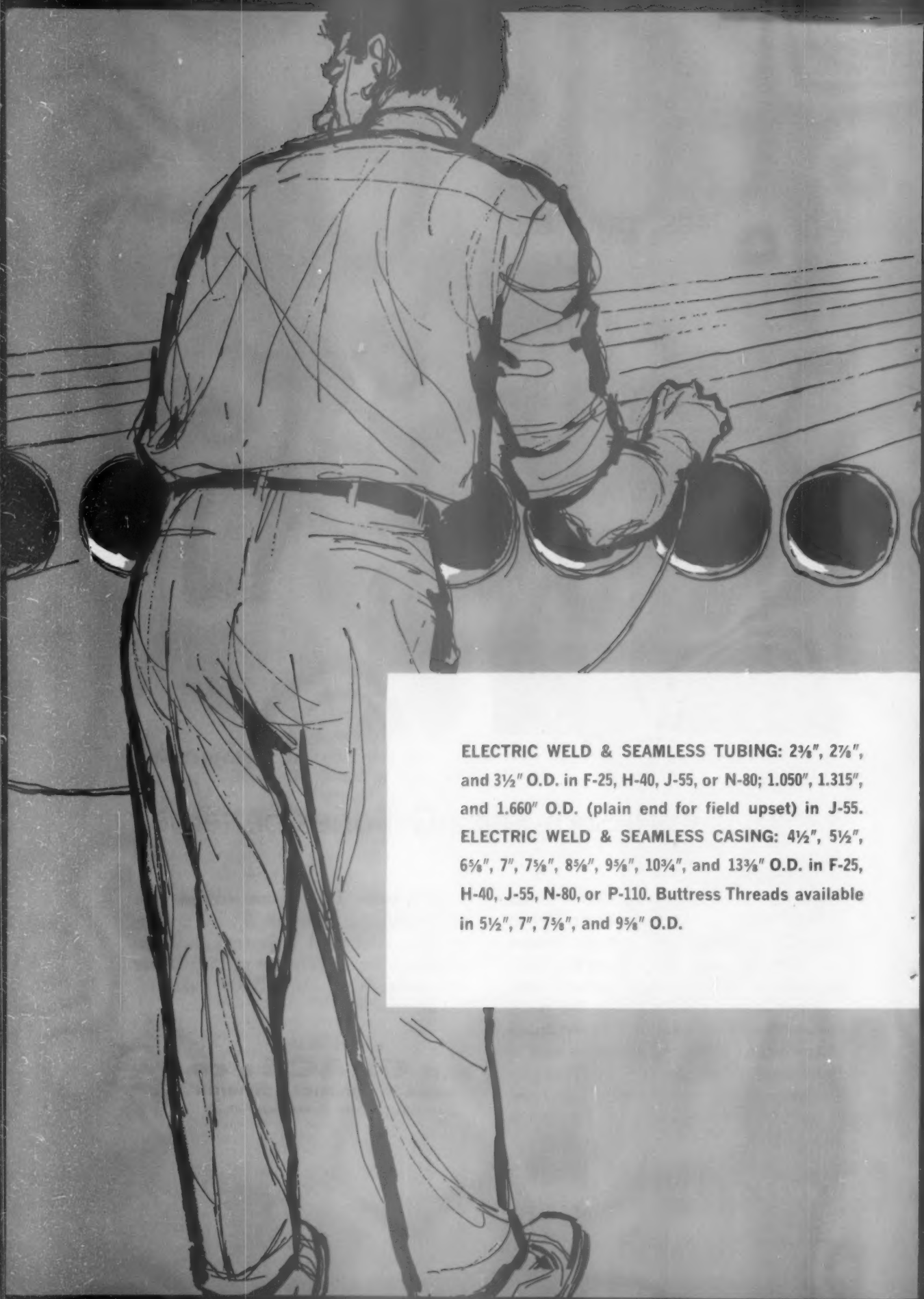

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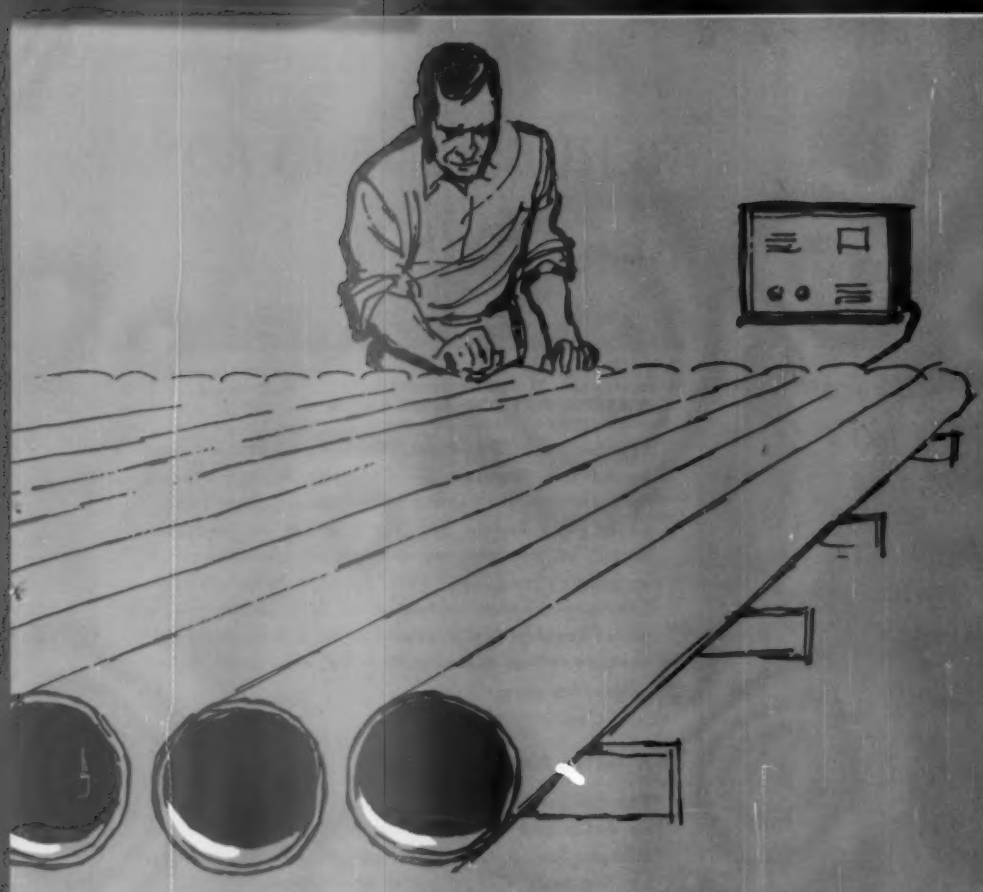

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Service is a strong point. Republic offers expert metallurgical and design assistance . . . a new, multimillion dollar order entry system that simplifies the job of locating and ordering pipe . . . extensive field and mill inventories . . . and a broad, customer-conscious line of casing and tubing.

Let us quote on your next pipe requirement. Direct inquiries to your Republic sales office. For general data on Republic Casing and Tubing, mail the coupon on the following page.

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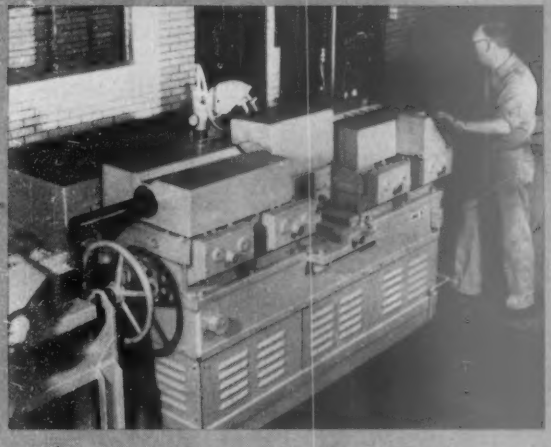

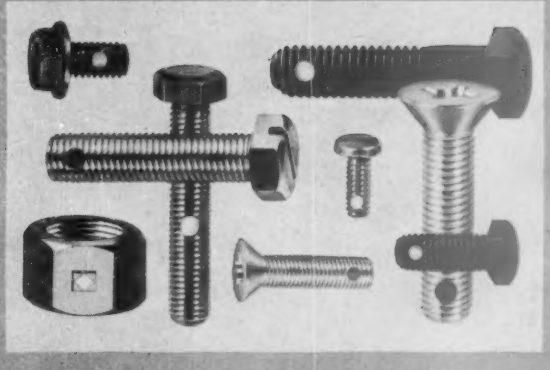

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You can specify FARROWTEST® nondestructive testing at no extra cost with Republic's ELECTRUNITE® Heat Exchanger Tubing. Offered as an alternate to other less positive tests, FARROWTEST is an electronic method of detecting and rejecting critical defects. ELECTRUNITE Tubing is formed from highest quality flat rolled steel —carbon or stainless—and welded without the addition of foreign metal. Mail coupon for details.

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Associated Business Publications

They Say—

A healthy trend

Dear Sir:

I am most encouraged to see a publication with the stature of yours give increasing attention to the marketing segment of the oil business.

In the last couple of years I think it has been brought home more forcefully than ever how mutually interdependent each of the branches of the oil industry is on one another.

The producer, the refiner, and the transporter must know about and understand the problems of the marketer if we are to have a sound and healthy industry.

A. J. Rumoshosky
Director, Division of Marketing
American Petroleum Institute

Sun's stocks down, not up

Dear Sir:

In the August 29 issue of The Oil and Gas Journal ("There's Enough Gasoline in Storage to Start Motoring Season All Over Again," p. 54) comparisons of crude-oil and major-product stocks reported by nominating companies to the Railroad Commission of Texas indicated Sun Oil Co.'s crude inventory on August 1, 1960 was 8,155,000 bbl., compared with 6,444,000 bbl. on the previous March 1.

For the record, the August 1 figure you show is total crude inventory, the March 1 figure is dispatchable crude inventory, and the figures are thus not comparable.

The comparable August 1 figure, as reported by Sun to the Texas Railroad Commission, is 5,495,000 bbl., a decrease of 949,000 bbl. from March 1.

Richard R. Anderson
Director of Production
Sun Oil Co.

Mobil's protest

Dear Sir:

Our high regard for the Journal and its accuracy prompts us to comment that someone must have gone fishing when the tabulation of product inventories was being checked for your August 29 issue (p. 54).

Consequently, we feel we owe you a protest on the method you used in calling attention to the inventory situation. Our comment is based on two things: 1. the figures you quoted for Mobil were incorrect; 2. the whole basis for your presentation seems to

GET YOUR PIPE IN A

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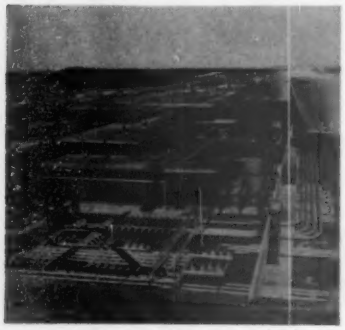

Another service of LATEX is PRODUCTS PUMPING STATIONS. LATEX has years of experience in this type of installation.

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fasten praise or criticism on individual companies without any analysis of the complicated factors that, in differing ways, influence each company's inventory position.

On the first point you quoted Mobil as having a gasoline inventory on August 1 of 17,158,000 bbl. versus actual stocks on March 1 of 16,376,000 and desired March 1 stocks of 15,516,000.

Actually, the first figure was filed as of August 9, showing July 1 stocks, not August 1. Your figures for Mobil of 17,158,000 bbl. includes both finished and unfinished stocks. It should have read 14,835,000 bbl., which was our finished gasoline inventory as of July 1 and which can thus be compared with the finished stocks you show for March 1.

You might like to know that for August 1, Mobil's finished gasoline inventory was 13,700,000 bbl., though this figure was not available at the time of the last Railroad Commission request. Thus, between March 1 and August 1, Mobil's gasoline stocks dropped by approximately 2,700,000 bbl. Unfinished stocks remained reasonably constant during the March 1-August 1 period.

More basic, however, is our other objection. The only comparison of this kind that could possibly have validity is a comparison of August 1 stocks with what they should be on August 1, not with March 1, or April 1, or November 1, or any other dissimilar date.

Even this approach would be misleading simply because Mobil's inventory levels are arrived at through a series of complicated business decisions that involve a good deal more than some arbitrary "desirable" figure.

"Desirability" must take into account trends in Mobil's product sales and many other factors that shift constantly. To us inventory is at the right amount when it properly balances with anticipated need for product.

We simply do not feel that tabulation of inventories by companies can have any real value unless the reasons for inventory levels are fully explained and, in our case, this would certainly involve giving out market analyses, methods of operation, and other information we hope and believe our competitors do not have.

The Journal is an old stand-by of ours when it comes to keeping track of events. We think you slipped this time but still remain convinced that you do an exceptionally able job.

R. R. Jackson
Vice President,
Manufacturing and Supply
Mobil Oil Co.

Editor's note: Reader Jackson is

When selecting roller bearing pillow blocks, remember

it's what's inside that counts!

MAXIMUM SIZE AND NUMBER OF ROLLERS for highest capacity

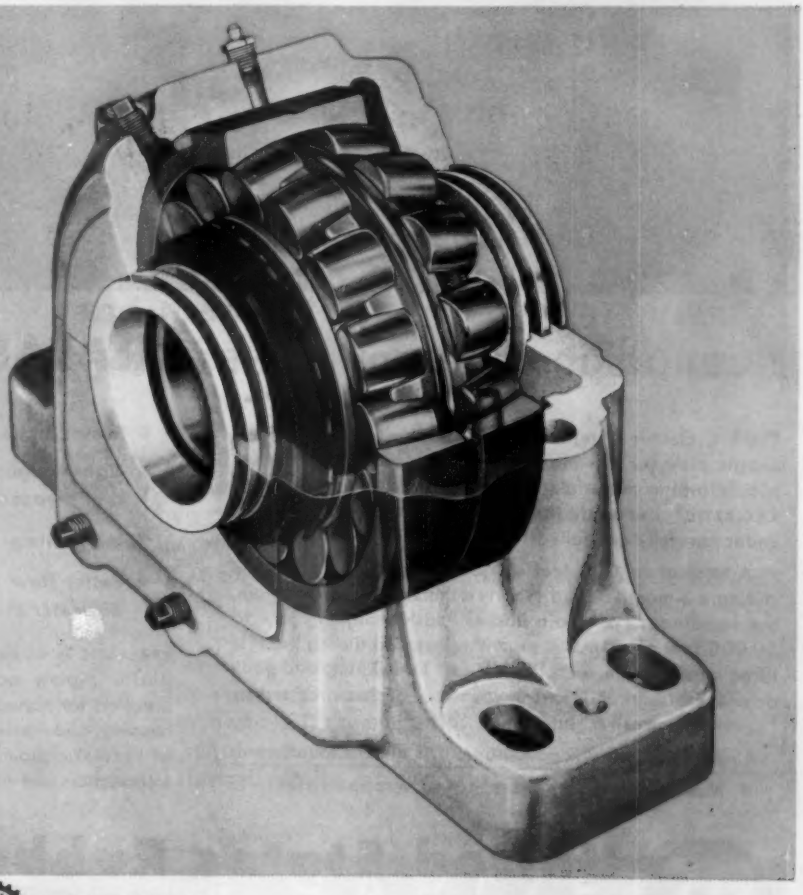
CENTRIFUGALLY CAST, PRECISION MACHINED BRONZE RETAINERS for smooth, quiet operation

HIGH, HEAVY INNER RING FLANGES for ease of installation and removal

AND INSIDE LINK-BELT ROLLER BEARING BLOCKS you'll find Link-Belt's new spherical roller bearings . . . with big, mirror-smooth, highest capacity rollers; centrifugally cast, precision machined bronze retainers; heavy, broad-shouldered inner rings. *All* the best features of modern bearing design compactly unitized for utmost economy and long service life.

Link-Belt spherical roller bearing pillow blocks are self-aligning. Available in adapter mounting and direct-shaft mounting types for shafts from 1 7/16" to 12". Choice of two effective seals: all-purpose steel, multi-labyrinth seals, or Dacron-contact seals.

For full details, call your nearest Link-Belt office or authorized stock-carrying distributor. Look under BEARINGS in the yellow pages of your telephone directory. Ask for Book 2760.



SERIES 6800, 6900, 7800, 7900 have exceptionally rugged, two piece housings—machined as two perfectly matched parts providing easy installation.

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LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in all Fields.

15,414-B

Naugatuck KRALASTIC

The Original ABS Resin

KRALASTIC pipe installation by B. C. Electric Co., Ltd. Pipe extruded by Pacific Plastics of Canada Ltd. Both of Vancouver, B. C.

Canadian company proves **KRALASTIC** advantages

The B.C. Electric Company, first Canadian company to use plastic pipe for gas mains, not only studied the various plastic piping materials available before deciding upon KRALASTIC®, but made this original KRALASTIC installation under carefully controlled test conditions.

A total of 64,000 feet of KRALASTIC pipe was installed during a 3-month period. Nearly a third of this was 3" main, the remainder 1¼" main and ¾" service lines. Close to 50,000 feet of KRALASTIC pipe was installed during the first three weeks alone, with 10,000 feet laid during one peak day. Some soil conditions encountered were described as "severely corrosive" and "quite rocky."

Among the KRALASTIC advantages B.C. Electric found were:

- **Material cost less than that of wrapped steel**
- **Faster, more economical installation**
- **Light weight, ease of handling and fabrication that pleased installation crews**
- **Indefinite projected life**
- **Better flow characteristics and greater inside diameter than conventional pipe of same O.D.**

KRALASTIC is already the most thoroughly proved of all plastic piping materials, with more than 14,000 miles installed for natural gas, electric, water, chemical, radiant heating, and waste disposal lines. Prove the solid economy of KRALASTIC piping and conduit to yourself. Write for full information and names of nearest fabricators.

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right. In Mobil's case, total gasoline stocks in July were compared with finished stocks only in March. The Texas Railroad Commission's March report carried only one figure on gasoline stocks by company. As in API, Bureau of Mines, and other reports, this implies total stocks, as was the case with other companies. The Journal sincerely regrets an honest error. Mr. Jackson's basic objection is one with which we can sympathize, but not completely. The industry places much importance on current data concerning crude runs to stills, product stocks, and other pertinent figures; so does the Railroad Commission. Whenever such data are available, the Journal will continue to publish them as an obligation to its readers.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

SEPTEMBER

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Granada Hotel, San Antonio, Tex.

20-21 Illinois oil industry convention, sponsored by Illinois Oil and Gas Association, Illinois Oil Council, Illinois Petroleum Marketers Association, and Chicago Gasoline Jobbers Association, St. Nicholas Hotel, Springfield.

20-21 Ohio Petroleum Marketers Association, fall conference, Netherland-Hilton Hotel, Cincinnati.

21 American Petroleum Institute, Coalinga-Kettleman chapter, annual barbecue and golf tournament, Polvadero Country Club.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

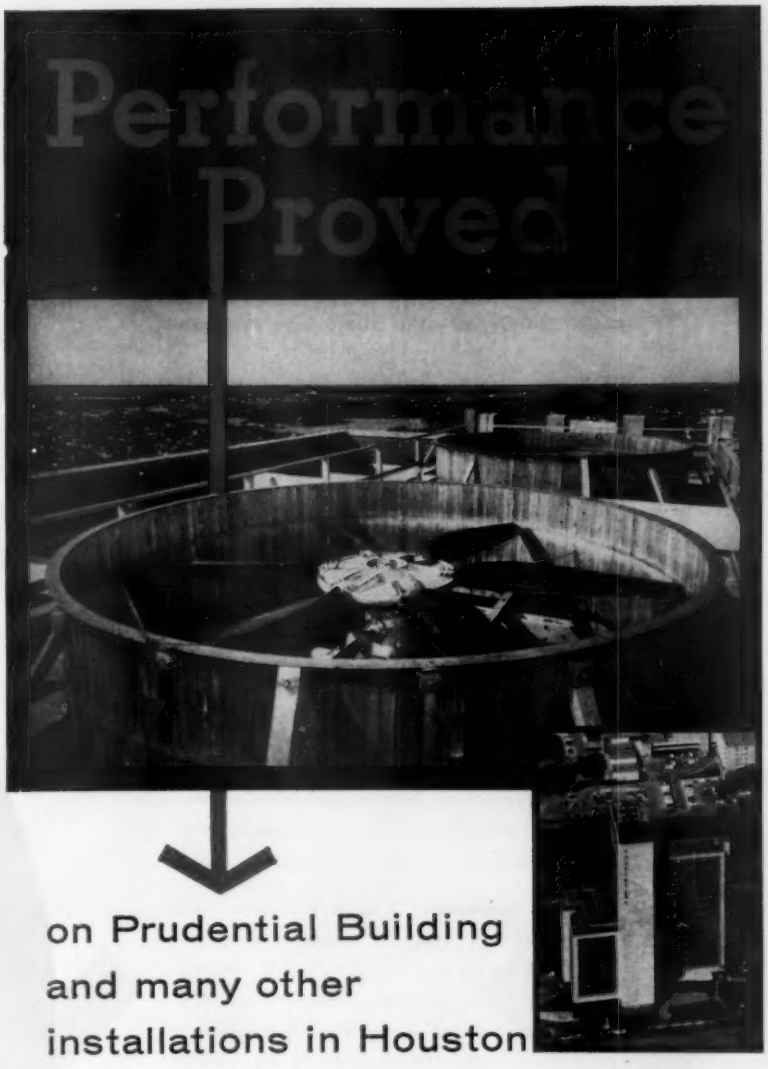
26-29 American Welding Society, fall meeting. Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

28-30 University of Oklahoma and National Association of Corrosion Engineers, central Oklahoma section, seventh annual corrosion control short course, North Campus, University of Oklahoma, Norman.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.



on Prudential Building and many other installations in Houston

Throughout Houston, the air conditioning capitol of the world, and the Gulf area, Hartzell cooling tower fans are being used in many commercial and industrial installations such as the one on top of the Prudential Building.

This 14′, 6-blade assembly is operating in an induced draft tower and has given *completely trouble-free service during its 6½-year life time.*

Here is another example of the kind of *service and long-life bonus* many owners of Hartzell fans have welcomed in their cooling towers and heat exchangers in the Houston area. Whatever your requirements for large diameter fans and cooling capacity, Hartzell has the fan to do the job.

HARTZELL

Engineering Offices in Principal Cities

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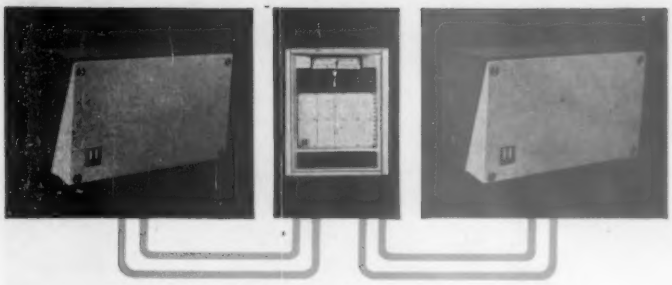
Div. of Castle Hills Corp. Piqua, Ohio



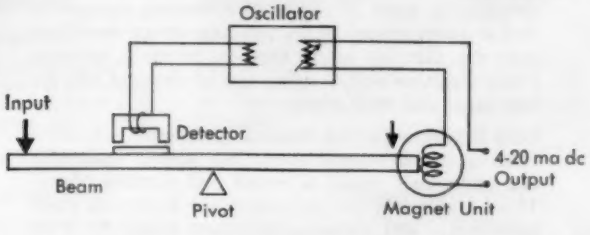
***ElectriK Tel-O-Set*—the true 2-wire system**

Care and feedback of delicate inputs

Delicate inputs thrive on the tender care of *ElectriK Tel-O-Set's force-balance feedback system*. This system, used as the basic circuit in *Tel-O-Set* transmitters, receivers, controllers, and other instruments, has proved itself in thousands of installations in the last five years. The force-balance feedback circuit increases the accuracy and dynamic response of the system by decreasing hysteresis effects and sensitivity to changes in ambient conditions.

Observe: (1) input force (from bellows, Bourdon tube, or displacement linkage) deflects pivoted beam; (2) air-gap in ferrite detector increases, (3) producing a change in inductance in oscillator circuit; (4) a portion of output current is fed back into magnet unit, producing a force on beam which is equal and opposite to input force; feedback balances beam. Full scale motion is only one-thousandth of an inch.

The advanced control engineering seen in force-balance feedback is carried through the entire *ElectriK Tel-O-Set* System. Specifically, there's no external power required at any field-mounted *Tel-O-Set* instrument. Line power connection is made only at the receiver. Two-wire d-c transmission eliminates shielding problems. The 4-20 milliamp signal range of the system gives a live zero and permits the use of the most reliable transistors available. The d-c signals



can be fed into data handling systems and millivolt-actuated instruments . . . can be easily transduced to a standard 3-15 psi pneumatic signal to operate existing pneumatic systems.

Take a new look at your control applications with the *ElectriK Tel-O-Set* System in mind! Get complete technical data from your local Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, 21 Penn Street, Fall River, Massachusetts.

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First in Control

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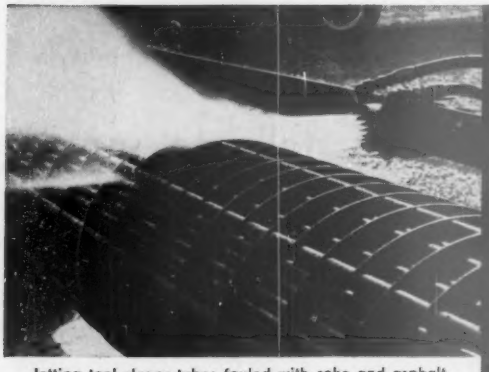
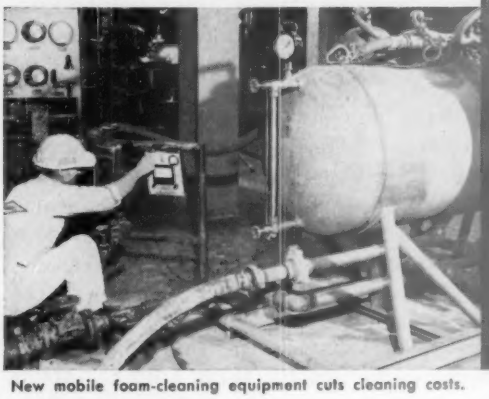
A new mark for a nation-wide cleaning service . . . DOW



Jetting tool cleans tubes fouled with coke and asphalt.



New mobile foam-cleaning equipment cuts cleaning costs.

Cleaning missile lines and components requires tolerances as close as 150 microns.

DOW INDUSTRIAL SERVICE

Industrial Cleaning. Dow Industrial Service, now a separate division of The Dow Chemical Company, offers the only nation-wide chemical cleaning service for virtually all types of industrial processing equipment. This is an expansion of the cleaning service developed over the past 20 years. Dow is currently servicing entire plants as well as doing special cleaning jobs for both large and small companies.

Dow Industrial Service research in industrial chemical cleaning has developed specialized mobile equipment and techniques, some of which are pictured above. These highly efficient techniques are improving plant productivity and reducing equipment downtime in all industries using steam generators, condensers, heat exchangers, towers, water and product lines, water wells and tanks, or similar process equipment.

Product Sales and Service. The sale of specialized chemical products, scientifically formulated to be of use in specific industrial processes and to give the necessary technical service in their use, is the job of Product Sales and Service. Purifloc* N17 is an outstanding new flocculant cleared by USPHS for use in potable water.

Laboratory Service. Because of the rapid development of chemical products for the municipal and industrial waste and water treatment areas, Dow Industrial Service will take on the service-selling of those products. Also, a consulting laboratory service for municipal and industrial waste and water treatment is provided.

You'll find Dow Industrial Service offices and stations with specialized cleaning equipment and experienced personnel in all major industrial areas. For more information, write to Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio. *TRADEMARK

DOW INDUSTRIAL SERVICE DOW *Division of THE DOW CHEMICAL COMPANY*

29-Oct. 1 West Texas Geological Society, field trip, Delaware basin of West Texas and southeast New Mexico.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

5 Society of Plastics Engineers, Inc., regional technical conference, Mark Hopkins Hotel, San Francisco.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-15 Southwestern Legal Foundation, American Association of Petroleum Landmen, second national institute for petroleum landmen, Dallas.

13-16 Taft, Calif., Oildorado, fifieth anniversary celebration.

14-15 University of Texas, E. P. Schoch lecture series on rate processes, Batts Hall Auditorium, Austin.

14-16 New Mexico Geological Society, annual field conference, Chama basin of northern New Mexico, registration, Taos, Oct. 13.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

17-Nov. 5 University of Oklahoma, School of Petroleum Engineering, short course in advanced drilling practices for engineers, University of Oklahoma, Norman.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Permian Basin Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference,

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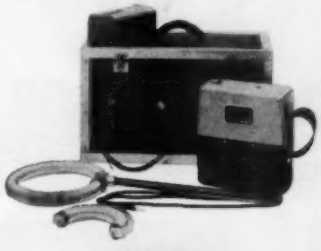
Continuity is all important in a protective coating. Whether it's a 90 mil coating on a pipeline or a 3 mil coating on a chemical tank, a tiny pinhole can lead to the destruction of the coating. Use of a Tinker and Rasor Holiday Detector will quickly locate pinholes as well as weak spots caused by air bubbles, coke, rust or scale. Minutes spent inspecting with a Tinker and Rasor Holiday Detector while the job is open can save days of down time later on.



Pipeline Detectors

E-P For damp or dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 pulsating voltage. Electrodes available: half circle, spring for pipe to 6", full circle to 30" silicone brush for flat surfaces.

E-4 This lower cost type of detector is specifically designed for smaller diameter pipe and flat surfaces with dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 D.C. voltage.

Thin Film Detector

M-1 For painted or sprayed thin film coatings. Maximum applied voltage 67½ V., non-destructive to coatings. Belt mounted, 4 lbs. total wt.

Underground Pipeline Detector

P-D For detecting holidays, electrical contacts or locating the pipeline itself, **without uncovering the pipeline.** Completely transistorized—long life and light weight.

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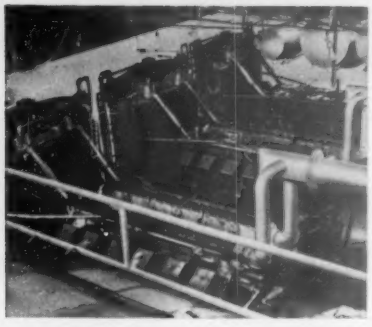

● Climax Engines have proven their reliability in hundreds of oil field installations. Single, well balanced design, rugged construction, and quality materials make them smooth running . . . for years!

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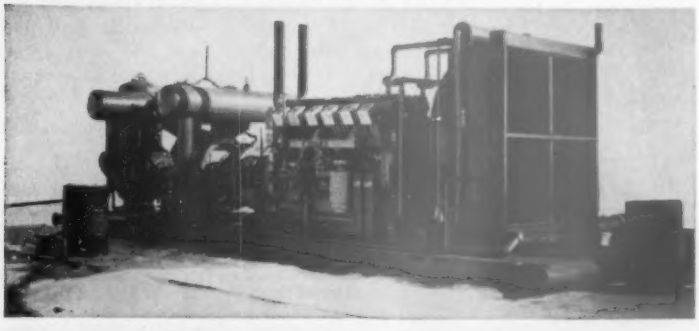
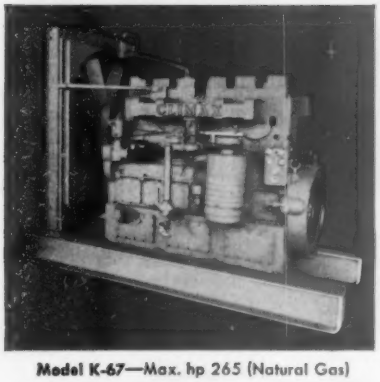
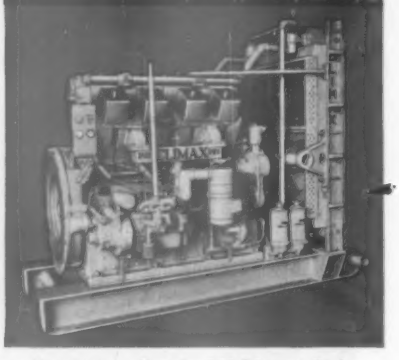




Model K-67—Max. hp 265 (Natural Gas)

Model V-125—Max. hp 605 (Natural Gas)



Model V-85—Max. hp 390 (Natural Gas)

CL-116

CONT. DUTY (NAT. GAS) →			DRILLING-PUMPING (80% RATINGS)						COMPRESSORS (65% RATINGS)				
Model	Bore & Stroke	Displ.	Peak Torque @ RPM	Brake hp at Speeds Indicated					Peak Torque @ RPM	Brake hp at Speeds Indicated			
				600	800	900	1000	1100		800	900	1000	1030
R-165	6⅛ x 7	1238	684 @ 750	81	105	117	127	135	557 @ 800	85	95	103	105
K-67	7 x 7	1616	955 @ 850	110	145	161	176	188	775 @ 800	118	131	143	146
K-75	7½ x 7	1855	1090 @ 800	126	166	185	204	218	885 @ 800	135	151	166	169
V-80	7 x 7	2155	1240 @ 850	140	188	210	230	246	1002 @ 800	153	171	187	190
V-85	7½ x 7	2474	1460 @ 800	164	223	246	266	284	1185 @ 800	181	200	216	221
V-122	7 x 7	3232	1920 @ 800	217	293	328	353	378	1562 @ 800	238	265	288	293
V-125	7½ x 7	3711	2240 @ 850	242	340	384	417	442	1820 @ 900	276	312	340	346

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY

FACTORY—CLINTON, IOWA

Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

31-Nov. 4 University of Oklahoma, petroleum landmen's institute, Student Union Building, University of Oklahoma, Norman.

NOVEMBER

3 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubricants conference, Hilton Hotel, San Antonio, Tex.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

22 Manufacturing Chemists' Association, tenth semiannual meeting and midyear conference, Statler Hilton Hotel, New York City.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

DECEMBER

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

9 Tulane University, School of Law, and American Association of Oilwell Drilling Contractors, fifth annual program on mineral and tidelands law, University Center, Tulane University, New Orleans.

26-31 American Association for the Advancement of Science, annual meeting, New York City.

JANUARY

16-19 Instrument Society of America, winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.

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100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

Darcova Pumcup

Darcova 45° Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

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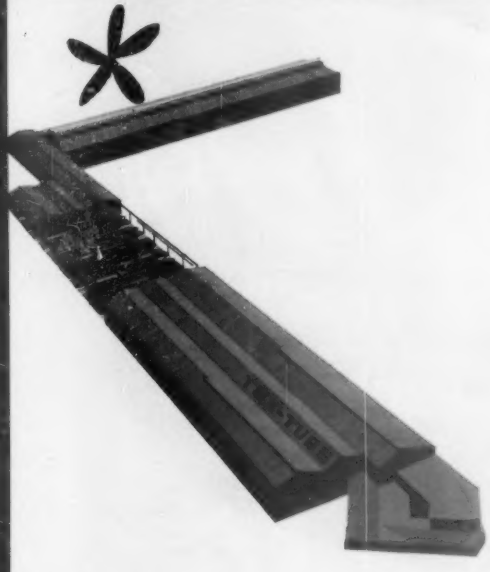
TEX-TUBE'S NEW PIPE MILL NOW ON STREAM!



In 14 short years, Tex-Tube has become one of the Southwest's major suppliers of light wall pipe, casing, tubing, and mechanical tube specialties. As demand for Tex-Tube products has grown, the growth of manufacturing facilities has been dramatic:

1955 — Pipe Mill #1
1957 — Pipe Mill #2
1960 — Pipe Mill #3

Now with Tex-Tube's *third* electric resistance weld pipe mill on stream it means that you—as a Tex-Tube customer—will get:

- a wider range of sizes and walls
- faster, more flexible mill schedules
- new items available for the first time in the Southwest (without the long, expensive freight hauls from Northern producers)

Tex-Tube has four stocking points, plus numerous jobbers throughout the South and West. Ample and varied stocks of quality Tex-Tube steel products are carried at locations in your area.

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High Tensile Lightwall Pipe
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DISTRIBUTORS
Oil Country Goods
Line Pipe
Refinery and Chemical Plant Piping

TEX-TUBE, INC.

1503 NORTH POST OAK ROAD • HOUSTON, TEXAS

Sales Offices in Midland, Dallas, Amarillo, Tulsa, Los Angeles and Pensacola

JOURNALLY SPEAKING

50 years ago

September 22, 1910

Newly formed California Consolidated Oil Co. takes over oil and gas properties of Mascot Oil Co., Premier Oil Co., and Yellowstone Oil Co. at Midway, Coalinga, Kern River, McKittrick, and Maricopa Flat in $5,000,000 deal, one of largest in California oil history. Purchase involves more than 550 acres of proven and undeveloped leases, nearly 50 producing wells with daily output of more than 4,000 bbl.

Prairie Oil & Gas Co. discontinues its gravity differential prices for crude-oil purchases, and posts a flat 40 cents per barrel for all grades. It is an increase up to 10 cents for heavier crudes.

Frisco Railroad reports it has converted more than 90 of its locomotives from coal to oil burners, and that those remaining will be converted as rapidly as possible.

25 years ago

September 19, 1935

Interstate Oil Compact Commission completes official organization at Oklahoma City meeting of governors or representatives of the six states which already had ratified the compact. Initial membership includes Texas, Oklahoma, Kansas, Illinois, New Mexico, and Colorado.

The Texas Co. discovers commercial oil production on Garden Island salt dome at mouth of Mississippi River and southeastern tip of Plaquemines Parish, Louisiana. The discovery makes this the Gulf Coast's most easterly field.

Michel T. Halbouty, formerly chief geologist and petroleum engineer with the former Yount Lee Oil Co., joins Glenn H. McCarthy, independent operator and drilling contractor, as head of his newly established geological, paleontological, and petroleum-engineering department.

10 years ago

September 21, 1950

Humble Oil & Refining Co. rig in Lake Sand field, on Louisiana Gulf Coast, drills 2,570 ft. in regular 8-hour tour to set new fast-drilling record. Record is set with new jet-type drag bit in 9⅞-in. hole from 1,910 to 4,485 ft.

Salt Lake Pipe Line Co., Standard Oil Co. of California subsidiary, completes and places in operation its new $12,000,000, 566-mile oil-products pipeline from Salt Lake City to Pasco, Wash. Eight takeoff points along route will supply a large portion of the Intermountain and Northwest regions with petroleum products.

Crude-oil production by Arabian American Oil Co. in Saudi Arabia climbs to all-time high of 585,800 bbl. daily.

Petroleum Perplexity

THE PUBLIC is all confused about the oil industry. Maybe that's nothing new, but the perplexity seems to be more so than usual.

ITEM: A recent wire-service news story from Santa Fe starts out:

"New Mexico schoolmen are frankly worried about the flow of revenue from the oil and gas industry, but the industry is healthy and the end is by no means in sight, says A. L. Porter, director of the New Mexico Oil and Gas Conservation Commission.

"And each side has an impressive array of facts and figures to support these views."

ITEM: An Oklahoma City newspaper's weekly prize for the best letter to the editor recently went to a man who wrote:

"What are the facts about Oklahoma's oil industry?

"One day the papers are full of dire predictions; the shutting in of all wells is imminent; production cutbacks are ordered, etc., including pipeline proration.

"Next day the oil-news section of the papers reports U. S. refinery runs climb 198,000 bbl., oil production is up nationally and is 39,100 bbl. higher in Oklahoma for the past week. . . .

"Economic importance of the oil industry to Oklahoma is such that people ought to be kept better informed about what is going on, and what the future may hold.

"Is the industry 'going to hell in a basket,' or is the current hassle over proration and production a temporary situation which will be overcome with the arrival of cold weather? Will national growth and increased consumption of petroleum products ultimately take care of any temporary oversupply?"

Those are good questions. Would anybody in the oil business care to answer them?

We have a hunch that quite a few oil men are just about as uncertain over the course of the industry as the general public seems to be. Some seem inclined to agree that the industry is indeed in a basket headed for that place mentioned by the gentleman in Oklahoma City. Others seem to think that the first touch of cold weather will wipe out all problems of oversupply.

The truth, of course, is neither of these extremes but lies somewhere in between. But just where in between is what has everybody guessing.

However, there are certain fairly well established facts which ought to be better understood by the general public, by investors, by the officials of states getting revenue from oil activities—and even by some conservation bodies and by some people in the oil business. These might be outlined as follows:

1. The U. S. will consume just so many barrels of oil in all its refined forms during a given period, and making more than that amount available won't induce people to use more.

2. Every year this country uses more oil than it did the year before, but during the last couple of years the rate of increasing consumption has not been as fast as it was during a long stretch of years following the war.

3. The oil industry, both in the U. S. and almost everywhere else in the world, expanded its capacity to produce and refine oil faster than the growth in demand for it. As a result, practically every segment of the industry must operate at something less than its maximum capacity.

4. It may take several years for demand to catch up with capacity, and in the meantime there will be some curtailment in the rate of drilling, producing, and refining.

5. The demand for oil is good and will get better; it just isn't as good as a lot of people had expected. So a lot of operations are pinched back and it's harder to make money under such conditions.

6. Oil should be considered a slow-growth industry instead of a boom industry. But it is basically sound and will be all right if everyone concerned recognizes the changed conditions and adjusts to them.

Does that clear up anything for anybody?

—Henry D. Ralph

Why you get more from Lenkurt Type 74A microwave –

Only *Lenkurt* microwave has tomorrow's

The Federal Communications Commission has proposed an immediate tightening of microwave frequency tolerances from today's ± .05% to ± .005%. Industry representatives have counter-proposed an immediate reduction to ± .02%, with a further reduction to ± .01% in 1965.

Lenkurt Microtel microwave equipment, alone, *already* meets the ± .02% requirement *without modification or additional equipment*. In fact, *existing* installations, with only a minor modification, will be able to hold a tolerance *better* than ± .01% . . . *better* than the industry's recommendation for 1965!

frequency stability already built in

Lenkurt Microtel achieves this performance because circuits and components were designed with tomorrow in mind. The heavy-duty one-watt klystron and the Invar reference cavity, for instance, neither use nor require temperature control to meet specifications. And automatic frequency control of the transmitter is *standard* on Lenkurt Microtel . . . it's not even available on most other microwave systems!

Our customers have come to expect such advanced thinking and engineering in all Lenkurt telecommunications products. Such "engineering for the future" saves you money, both in freedom from obsolescence and in greatly reduced maintenance expense.

With a complete product line, our experienced staff engineers are able to plan your systems efficiently and objectively. Call or write your nearest Automatic Electric representative, or the Director, Petroleum Industry Sales, Automatic Electric Sales Corporation, Northlake, Illinois.

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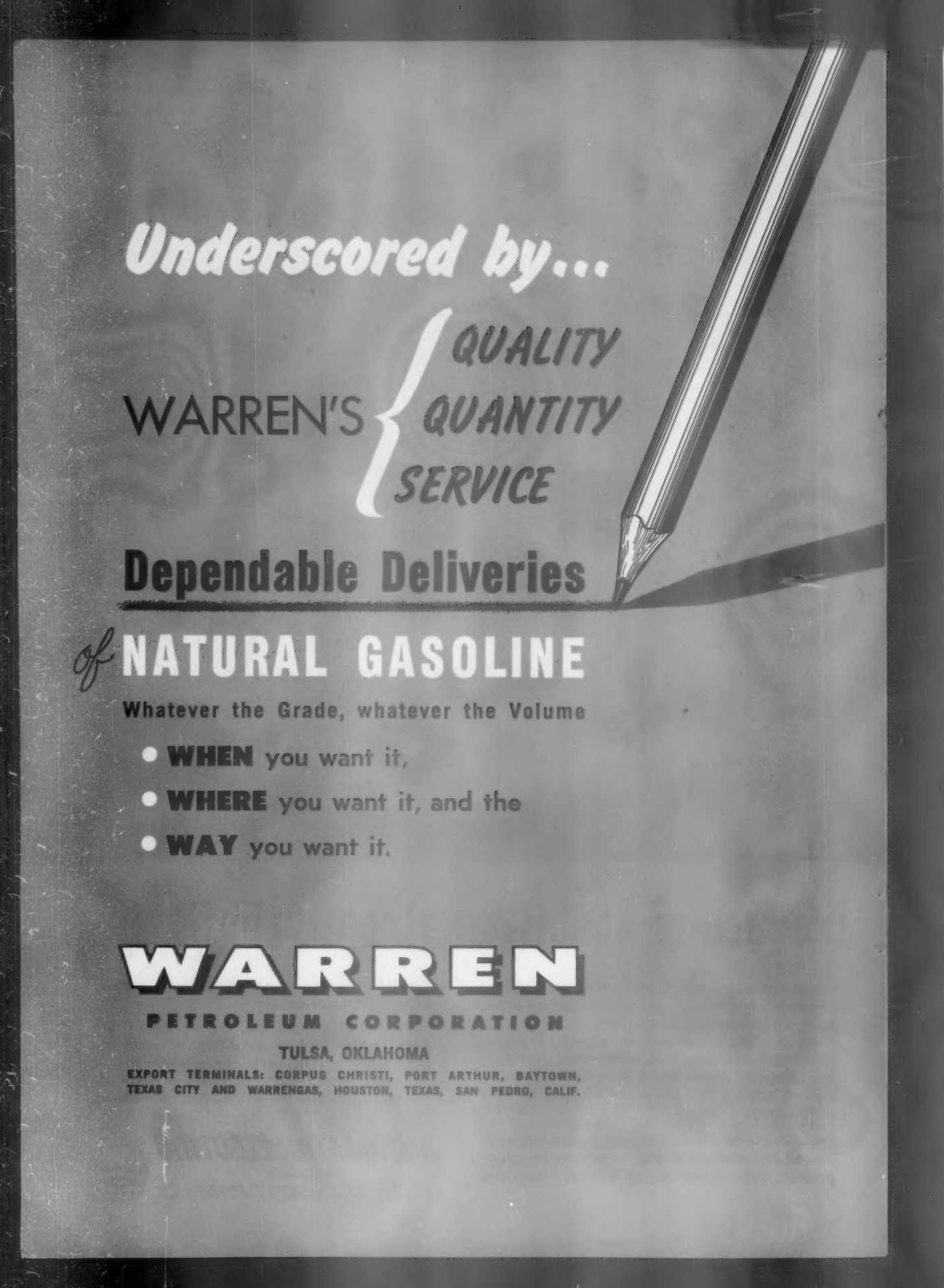
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The third great oil discovery

DURING ITS FIRST 100 YEARS the oil industry made two great discoveries. Now, in the beginning of its second century, it is making a third.

The first great discovery was that oil occurs in the earth and can be found by drilling in selected places.

The second great discovery was that oil does not produce itself but requires the aid of reservoir engineering.

THE THIRD GREAT DISCOVERY is that oil doesn't sell itself. This discovery is just beginning to dawn on producers, refiners, marketers, and governments all around the world.

For 100 years it did appear that oil sold itself. Except for a few brief depression periods the demand for oil seemed insatiable. The only problem was to get enough of it out where eager buyers could take it away.

Today, as a result of intensified application of the two basic discoveries of drilling and reservoir engineering, the availability of oil greatly exceeds the rate of consumption. The advent of a world-wide buyers' market comes as a shock to all suppliers, and many of them are having difficulty adjusting to it.

The pattern for action exists in the experiences of many other industries.

The first essential is to rationalize production, by one means or another, so that output approximates demand. Some jurisdictions in the United States and Canada have proration systems that serve this purpose, though imperfectly. Governments elsewhere are groping for something similar.

Not producing more than can be sold is an essential measure, but it's a negative, defensive one. It should be followed by a cogent, constructive program of expanding old markets and creating new ones.

The difference between finding a market and filling one is the difference between real marketing and just selling. Genuine marketing involves analyzing and anticipating a consumer's basic wants and then designing products and services to fit them.

OIL'S GREAT ENERGY, heat, and chemical properties can always find uses among the shifting needs of a rapidly industrializing world. The successful supplier—company or country—will be the one who best seeks, nurtures, and serves these needs against the competition of alternate sources.

Oil won't sell itself these days. Mere possession of oil is no longer a guarantee of prosperity. The realization of this has started a revolution in oil marketing—beginning with a critical examination of old delivery methods and pointing toward new ways of enticing and satisfying consumers.

Plane, Train or Limousine?

(none of these, this is a helicopter!)

Looks like a conference room, doesn't it? Well, it is in a way. The cabin of this new turbine-powered Sikorsky S-62 was designed by Raymond Loewy to make every trip conducive to meetings, study, work and even rest.

The turbine engine not only contributes to this atmosphere with its smooth, quiet operation but also has an unequalled record of reliability to recommend it. And because the mechanical components of the S-62 have been proven in over 1,000,000 hours of flight, periods between overhauls are four to five times longer than would normally be expected of new components.

This nine-passenger, boat-hulled Sikorsky S-62 is the newest addition to the family of helicopters you so often see in the news transporting government dignitaries both here and abroad. As it does for them, a Sikorsky helicopter will cut your executives' traveling time considerably.

So today, jot a note to Sikorsky Aircraft on your letterhead and a representative will call to show how your company can gain in *business*, in *time*, in executive *power* and in *prestige* with a new Sikorsky S-62 executive helicopter.

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What's Coming in Canadian Oil Policy

• Signs indicate a government okay on widening the domestic crude market for western producers. Despite vigorous campaigning by independents, there seems to be no likelihood of early approval for an Alberta-Montreal pipeline.

Gene T. Kinney
East Coast Editor

WESTERN CANADA producers are optimistic about winning an increased domestic market for their crude under an oil policy which the government is expected to adopt before year's end.

And the feeling in the industry—including some of the Montreal refiners, who generally oppose any government action—tends to confirm their optimism.

Under mounting pressure to "do something" to increase production from the present rate of 550,000 bbl. daily, which is only half capacity and far below the Borden Commission target of 700,000 bbl. daily, the government is expected to abandon its hands-off policy.

The updated performance reports and plans of major oil marketers, recently submitted to the National Energy Board, are undergoing a hurry-up review (OGJ, Sept. 12, p. 78). A national oil policy—or action by the majors to use more Canadian crude—is likely to result from new recommendations to the government.

What the national policy—or company action—will be is not known at this time, but the best bets seem to be these:

...The Ontario market will be fenced off for Canadian crude as far east as the Ottawa Valley, just west of Montreal.

This could mean two things: 1. Supplying most of eastern Ontario from refineries at Sarnia and Toronto, rather than Montreal, and 2. Shutting off imports of some 10,000 bbl. daily now being brought into Ontario by Sun Oil Co., Ltd., and Texaco Canada, Ltd. (for Regent Refining).

...The drastic steps of forcing prairie oil into the 250,000-bbl. daily Montreal market by imposing import controls and government support for a $300-million Alberta-Montreal pipeline are not considered to be in the cards at this time.

The Energy Board is working amid a clamor by Alberta independent producers of "on to Montreal" with the pipeline. Importers, meanwhile, are generally restating their "free enterprise" position favoring the rule of economics — meaning continued imports of Middle East and Venezuelan crude into Montreal.

But the importers are beginning to feel that the time for giving more of the Ontario market to Canadian crude is at hand. Some—including Montreal refiners who serve part of the market with products from foreign crude—are outspoken in favor of the moderate eastward push for domestic oil.

This step will not bring the spectacular jump in production desired by Montreal pipeline advocates, but it will add a market of about 60,000 bbl. daily.

This, together with newly authorized gas exports, which by 1962 will amount to the equivalent of 150,000 bbl. daily of crude, should buoy the western industry and take off part of the heat for full-scale imports controls.

Ontario imports eyed . . . The most logical first step, in the view of many producers and some eastern refiners, is to consolidate the Canadian position in Ontario.

This means stopping the 10,000 bbl. daily (5,000 bbl. each by Sun and Texaco) now coming into Ontario.

British American Oil Co., Ltd., and Imperial Oil Ltd., both Montreal importers, have made this suggestion.

British American strongly believes that the market for petroleum products in Ontario west of the Ottawa Valley should be supplied with products refined from Canadian crude oil "with certain exceptions," the company told the Journal.

The exceptions are "to the extent that imports of certain products (mainly middle distillates and residual fuel) are required to balance refinery yields against market demands, and to the extent that satisfactory Canadian crude oils are not available for manufacture of certain specialty products."

The expansion of the Ontario market is seen as "a logical step in the further development of markets for Canadian crude oil because of the fact that the pipeline facilities (Interprovincial Pipe Line Co.) to supply this market are already in existence . . ."

British American noted that "an immediate additional market" of 10,000 bbl. daily would be available by eliminating imports.

Vernon Taylor, vice president of Imperial, also mentioned this step. He added the qualification that "rigid restrictions are not desirable and should not be resorted to until every other effort has been made to induce importers to use Canadian crude and products."

Sun has expressed its intentions to continue importing its 5,000 bbl. daily from Venezuela.

Eastern Ontario market . . . A further market of 50,000 bbl. daily could be opened to Canadian crude by displacing products transferred from Montreal refineries into Ontario west of the Ottawa Valley.

This assumes that balanced refining capacity could be made available and this switch cannot be made overnight. It disrupts supply and distribution patterns, transportation facilities, and alters individual company economics and competitive positions.

"In actual fact," British American says, "it is doubtful whether Ontario refiners in 1961 could supply more than the equivalent of 30,000 bbl. per day of this potential market . . . even if all the available surplus capacity that exists today could be fully utilized."

On this point, the company has a word of caution:

"In our view, however, any arrangement for the utilization of available refinery capacity in Ontario for this purpose must be governed by the economics of individual company operations in order to avoid imposing any undue economic penalty or competitive disadvantage on any one company."

Giving more of eastern Ontario to Canadian crude could alter the tables

NEW Montreal refinery of British Petroleum using imported crudes complicates drive of western Canadian oil producers for eastern markets.

for expanding existing Ontario plants and building new ones. For example, it could cause Shell Oil Co. of Canada, Ltd., to consider building its projected Toronto refinery sooner than was planned.

Reversing Trans-Northern . . . The major transportation change would involve partial reversal of Trans-Northern Pipe Line Co.

This 10-in. line pumps 60,000 bbl. daily of products westward from Montreal to Toronto and markets in between.

Owned by Shell, British American, and Texaco, the line carries products of these three Montreal refiners as well as two others—BP Canada, Ltd. and Canadian Petrofina, Ltd.

The reversal under study would result in products' movement from Toronto eastward to the Ottawa Valley, contiguous to Montreal, and from Montreal westward only to that point.

Trans-Northern has conducted engineering and economic studies looking toward the possibility that the reversal may be forced. Pumping equipment, manifolding, and major storage changes would be required. It could be done, but it would be more complex and expensive—especially from the storage standpoint—than the company had anticipated. Nor can the line operate as economically under this procedure, with smaller inputs at Montreal and Toronto instead of the large input at the single point.

Montreal problems . . . Action to push Canadian crude farther east would run counter to existing economic pressure.

Eastern Canada, with 65,000 bbl. daily in new refining capacity this year, is swimming in products.

BP has started up a new 25,000 bbl. daily refinery (see photo) near Montreal, and Irving Refining, Ltd. (Irving Oil Co. and Standard Oil Co. of California) is operating its 40,000 bbl. daily plant.

With this substantial new capacity, and its attendant capital outlay, the pressure is to expand the eastern market for products from imported crude—not reduce it.

U. S. markets . . . Besides expansion in Ontario, Canadian producers can look forward to gradually increasing markets in the U. S.—particularly the north central states.

Canada now exports about 115,000 bbl. daily to U. S. regions with refining capacity of 1,250,000 bbl. daily, and can expect a growth with the increase in demand. It is also picking up new customers.

Mobil Oil Co. is ready to start taking 5,000 bbl. daily at Trenton, Mich., near Detroit, and Gulf Oil Corp. will take a like amount at Toledo, Ohio.

Responses from Texaco, Shell and Mobil indicate that the Puget Sound area of the Pacific Northwest is static for the moment. There Canada is up against cheap Middle East and Far East supplies which have the advantage of current low tanker rates.

The Buffalo, N. Y. area, now supplied by the Illinois basin and Mid-Continent, may well open up to Canada soon. Studies show the Canadian economic position to be fairly good here, although not compelling.

Transportation facilities for U. S. crude are crowded. Any refinery expansion in this area would certainly result in a close look at Canadian oil, which could be brought in by laying a short line to Interprovincial west of Toronto.

Independent's position . . . The backers of a national oil policy to give all of Ontario and much of Quebec to domestic producers, argue:

. . . Many major oil marketers have dragged their feet or done nothing to meet Borden Commission goals to expand production, although some have done their share.

. . . Canadian crude, laid down through a new 36-in. pipeline, would be competitive with imports in Montreal.

. . . A production rate of only half of capacity and an imports drain of $400 million annually, can hardly be considered healthy economically or consistent with security or oil independence.

Importers' position . . . The importers' general position is that the Canadian industry is not doing badly at all and that the Borden targets were too much to hope for.

Imperial's Taylor sums up:

. . . Market growth this year should be about 9%, compared with 2½% for the U. S. and 2% for Venezuela and the Middle East. This comes on top of an 11.5% gain in 1959.

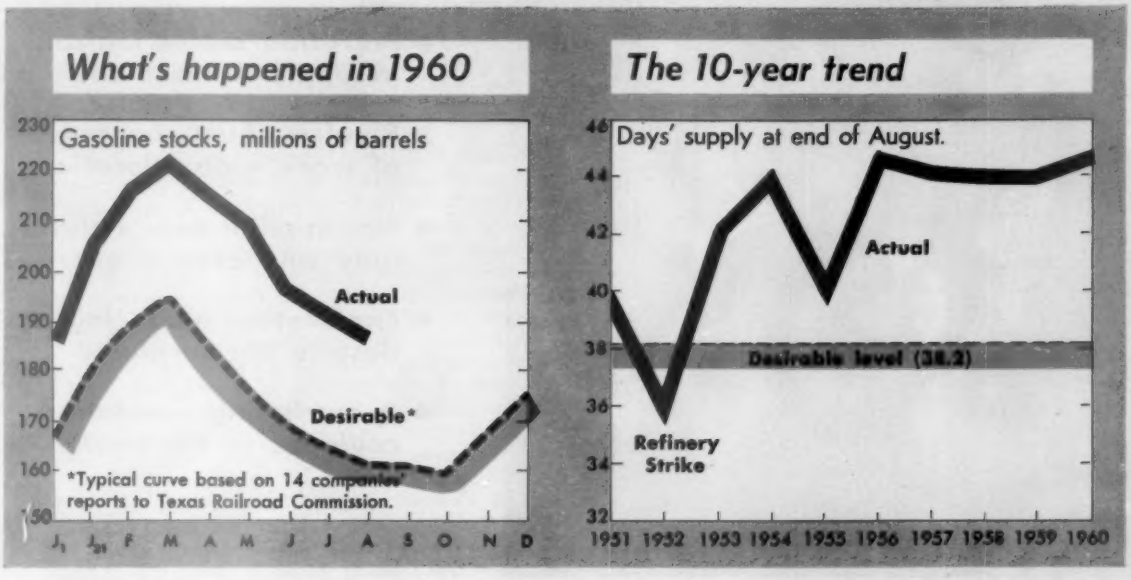
. . . Production at year end should be 600,000 bbl. daily; and 10 years hence, with expansion in domestic demand and U. S. exports, the rate should reach 1,250,000 bbl. daily.

. . . Oil revenues in 1959 amounted to $259 million, up 6% from 1958.

. . . Gas revenues in 1959 were $31 million, up 35% from 1958.

. . . Exploration drilling was up 7% in 1959, development drilling down 10%. Expenditures for the two were about the same for the 2 years.

1960's Gasoline Glut Is No Sudden Thing



EVERYONE agrees that gasoline stocks are too high and that refiners collectively have failed to do anything about them.

Truth is, this is not a sudden occurrence—it's been happening now regularly for at least the last 7 years.

The charts tell this story quickly:

Gasoline stocks in 1960 have been far above desired levels every month in the year (left chart above). At the end of August, they were about 28,000,000 bbl. too high.

This estimate of oversupply is reached by comparing two sets of figures. The API economics department reports gasoline stocks at almost 189,000,000 bbl. at the end of August. Reports of 14 major oil companies to the Texas Railroad Commission indicate the most desirable level of gasoline stocks at that time should be 161,000,000 bbl.

This is not new. Measured by the days' supply on hand at the end of August each year, these stocks have exceeded the desired level every year since 1952 (chart at right).

What has happened in 1960 (chart at bottom) sheds light on the trend. In the first 3 months of the year, stock increases, although less each month, exceeded the 6-year average. From April through June, stock withdrawals were less than the average. Only in July and August did withdrawals from inventory this year outmatch the average.

What does this mean?

If gasoline stocks follow the normal seasonal trend, there will be very little decline in stocks in September or October. Then heavy additions will start in November.

So if operators expect to work off some of the 28,000,000-bbl. surplus between now and the end of the year, they will have to make unusual adjustments in runs and yields.

Stocks don't have to increase at the same rate as demand, because any surplus inventories produce soft markets. A soft market is a sure sign some refiner has been caught with more gasoline in his tanks than he needs to meet his normal sales program.

It also shows that some other refiners are in the same trouble. If all other refiners were in balance or a little short on gasoline, the first refiner would have no trouble selling his surplus.

The 1960 Story: Too Rapid a Buildup

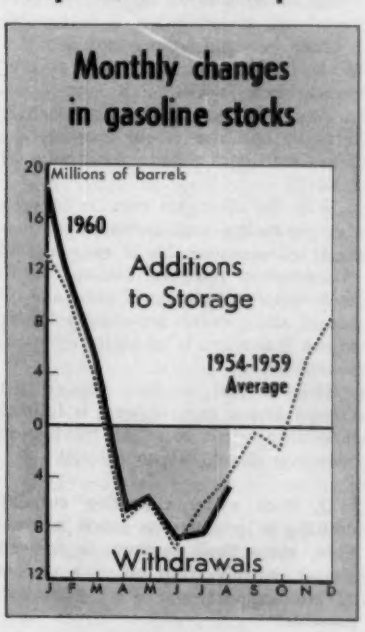
THE monthly changes in gasoline stocks charted at right show an above-average buildup in stocks occurred this year in the first 5 months.

Only in July and August did stock reductions fall below the 6-year average.

In the chart, points above the break-even line indicate net stocks going into storage—points below indicate that net withdrawals occurred for the month.

Thus in the first 3 months of 1960 more gasoline went into storage than the average for that month. The big accumulation was in January when additions amounted to more than 19,000,000 bbl. compared with a 6-year average of 13,000,000 bbl.

April, May, and June inventories decreased but at a less sharp rate than average. Top withdrawals were in June when stocks dropped 8,800,000 bbl., compared with average drop of 9,436,000 bbl. Only in July and August did refiners cut gasoline stocks more than average. The July cut was 8,300,000 bbl. compared with 6,141,000 bbl.



SOME THINGS

- ***Proration seems logical in supply-demand dilemma***
- ***Rivalries hurt chances of worldwide allocation***
- ***The Russian Bear's claws may sink even deeper***
- ***Exploration won't lag despite big surpluses***
- ***A marketing revolution could be in the works***

Q. Mr. Kimball, as executive vice president for operations of Sinclair Oil Corp., you will have to cope with the industry's No. 1 problem which has come to be called, "management of the surplus." What can be done about the worldwide surplus in productive capacity and refining capacity?

A. The existence of both of these conditions at the same time certainly complicates the matter. The international oil companies, in the past, have been able to maintain a reasonable balance between supply and demand. With the increase in number of producing areas and in participating companies, this has become increasingly difficult and the world markets are now faced with a growing surplus of crude.

With the divergent interest between the producing and consuming countries, it is questionable if international oil company restraint will suffice to keep supply in check. If you take oil out of the ground, someone is going to run it as there is ample refining capacity.

This is just as true outside the United States as it is here; it follows then that some form of production proration should be considered.

Q. With every exporting country desiring to produce as much as possible, since their revenue is derived almost entirely from oil, is a system of international market allocation possible?

A. It would not be a simple matter, although the economic salvation of the producing countries would seem to demand some action of this nature. International conservation is just as essential now as domestic conservation was 30 years ago, but it is a question of the older producing areas making room for the new—Libya, Sahara, Argentina, etc., and this is not very promising.

Governments and private oil companies must learn how to live when necessary with excesses of potential supply over demand and at the same time provide the incentive to maintain reserves for meeting the ever-increasing worldwide demand for energy.

Q. How long is a surplus in producing capacity likely to continue?

A. The surplus is growing, and could be with us for some years. The only course that makes economic sense in this situation is to produce only what is needed. Any excess production over demand can only lead to disorderly markets.

Q. Who would set up the machinery for international proration?

A. It would have to be done by the governments of the exporting countries themselves, but the widely divergent positions of the historic producing countries would have to be reconciled with the newer-producing companies—Kuwait vs. Libya, for example.

Q. Is anything being done in this direction?

A. Venezuela and Saudi Arabia are at least exploring the possibilities.

Q. Russia is suddenly becoming a factor in the market, with exports of approximately 500,000 bbl. daily. Where does she fit into this picture?

A. Russia has become an important influence in the world market. The Soviets are dumping crude and products now at prices way below the market, using this as a tool to upset the economies of the free world. When they complete the pipeline now being built into eastern Europe, they could cause a lot more trouble in the market.

Q. How is domestic proration handling the surplus in this country?

A. Our states aren't too different from foreign-producing countries. Texas is the outstanding state showing real statesmanship, although some of the other producing states at present are also holding the line.

Q. Who is to blame for overproduction?

A. All of us—states and producing companies, major and independent, we're all in the same boat. Many have been doing things they shouldn't—producing oil with little regard for demand. As a result, crude was overproduced last spring—resulting in distress prices of both crude and products totally unrelated to actual costs.

AHEAD. . . *as seen by Sinclair's Thomas B. Kimball*

THE ELECTION of Thomas B. Kimball as executive vice president-operations for Sinclair Oil Corp. reflects the growing importance of coordination as a separate executive function in a big and complex business.

In this position, formerly held by E. L. Steiniger, now president, Kimball will coordinate the operating activities of all domestic and foreign subsidiaries of the parent company which itself is a holding company not engaged in operations. He will thus relieve Steiniger of these responsibilities which he has continued to carry since becoming president.

In his previous position as president of Sinclair Refining Co., encompassing refining, supply, transportation and marketing activities, he was responsible for the operation of Sinclair's largest subsidiary company. As an executive vice president of the parent company, he will be coordinating all of the integrated operations, foreign and domestic.

A California farm boy, Kimball was graduated from the University of California with a BS in chemical engineering in 1923.

His first job in the oil business was with Shell Oil Co. In 1930 he joined the research and development department of Sinclair Refining Co. at East Chicago, Ind. He was later in charge of the cracking division and of process engineering and development of light-oil processes for Sinclair refineries.

He was transferred to New York in 1943, and was appointed assistant manager of refineries in 1950, and, later, general manager. He was appointed vice president and director of manufacturing in June 1956.

In 1958 he was elected president of Sinclair Refining Co. and also a director of the parent company.

During World War II, Kimball served on several government-industry committees. He was active in the production of aviation gasoline. During his career, he has developed numerous patents on light-oil treating and on thermal and catalytic cracking.

Kimball is a sometime golfer, gardener (he raises prize azaleas), and an avid trout and salmon fisherman.

A practical man at work or at play, he prefers fly fishing, but is not above using bait if that's what it takes.

He is also fond of pleasure driving, as a top gasoline salesman should be.

Q. Have conditions improved materially?

A. Somewhat: The industry should have learned the lesson the hard way last spring, but we can thank General Thompson of the Texas Railroad Commission for bringing the most sense to the situation. He has done more for the oil business, with his conservation wisdom, than any other man in avoiding excessive, wasteful production. If we had more General Thompsons, we would have a sounder industry.

Q. Considerable effort seems to be under way to adjust refinery runs more closely to demand. Is it working?

A. To a degree. The industry has been refining too much crude and has not yet learned to gear operations to a reduced rate of growth. And the imports program, by encouraging some quota holders to run more crude to qualify for a higher quota, is making the situation worse.

Q. Should the quota system, in your opinion, be scrapped?

A. A quota system or some kind of arrangement is necessary to protect the domestic industry in the interests of national security.

Q. What's wrong with the present quota system?

A. Besides inspiring excessive refinery runs, the system as now set up is nothing but a subsidy for many companies without a dollar invested in production abroad, at the expense of those who have risked large investments to develop foreign production. Furthermore it is monopolistic and discriminatory as interpreted by administration from Washington.

Q. What is the likelihood of a change in the quota system?

A. I believe that the injustices and inequities to which I referred above will be corrected in time.

Q. With a surfeit of oil around the world, can we expect reduced efforts in exploration?

A. No. The oil finder is still king. With time needed to develop and increase reserves for anticipated demand over the next decade, the search for oil and reserves must continue. More than half of the capital outlay by the oil industry will continue to go into this activity.

Q. Where is the best place to look for oil?

A. The known area with the greatest potential, worldwide, appears to be the Sahara and North Africa generally. This has been a tremendous development. There has been nothing in the U. S. to equal the Sahara since East Texas 30 years ago.

Canada is more like the U. S., having smaller fields, but the far north country seems to hold considerable promise of large reserves. Lake Maracaibo in Venezuela is a good example of the fact that there are still some surprises left in the Western Hemisphere; newcomers have recently brought in wells there with productivity comparable to North Africa and the Middle East.

Q. How profitable is crude-oil producing in the U. S. today?

A. Many producers make their major profits today by selling reserves found years ago at a lower cost. A producer starting out in the business today has a much smaller margin to work on. For instance offshore production, though often occurring with sizable reserves, for the most part shows losses or at best break-evens because of extremely high development costs and low production allowables.

Q. Some observers have recently suggested that petroleum is finished as a growth industry. Is this true?

A. There is danger of stagnation in our growth only if we allow ourselves to be lulled to sleep. Aside from increased possibilities in gasoline and heating oil, there are many opportunities in asphalt sales and in chemicals and all forms of energy. We have problems, certainly, serious ones, but there are opportunities to match them.

Q. What are some of the problems not already mentioned?

A. We need to rectify the economic imbalance of natural gas and crude.

"... we're all in the same boat ..." "... get away from defeatism ..." "... the oil finder is still king ..."

Natural gas, at the present prices, leaves most of the burden of finding and production costs on crude. The government must permit gas to pay its own way. The present restricted-price situation has consequences which many of us still don't appreciate fully.

Q. What are some of the consequences?

A. The unjustly low price of gas at the well head results in unfair competition for heating oil, but this is only the beginning. As natural gas usage increases, it not only displaces heating oil, it brings with it increased volumes of low cost condensates which undermine the crude and products market.

Q. You mentioned opportunities a moment ago. What are some of them in, for instance, manufacturing?

A. Automation is, of course, the means by which all of us hope to contain costs, not only in manufacturing but in production and transportation as well. This will mean more capital investment per barrel but not necessarily less manpower. Automation permits more complicated processing of the crude barrel to meet ever-increasing demands for octane and higher quality products.

Q. What about chemicals?

A. Refineries are already essentially chemical plants, and the accent on chemicals as good profit items will increase markedly. I would not be surprised if 50% of capital investment at refineries is eventually devoted to petrochemicals. Increased investment coupled with research development will permit us to take a barrel of crude apart more completely and do more with it. When you find an opportunity to reach in and pull out pure chemicals, you often come up with a higher-profit product if you can find the right market outlets.

Q. What chemicals in particular look good?

A. Plastics are having tremendous growth and there are good opportunities for those who are in a position to supply the raw materials such as ethylene, propylene and the aromatics. Sinclair is a large supplier of paraxylene that goes into the manufacture of dacron type fiber in the U. S. and Canada. We are also a large supplier of orthoxylene and other aromatics to both foreign and domestic markets. One thing leads to another. We recently entered into a joint enterprise, as you know, with Koppers to produce styrene from ethlbenzene, one of the xylene isomers. Sinclair was the first with a commercial-size operation producing high-purity propylene.

Q. You said that 50% of refining capital may go into chemicals. How much of refinery throughput will this handle?

A. Throughput which undergoes conversion to chemicals will be on the order of 3 to 5%. The important thing is to get in there first with the product in demand. These things run in cycles. When the bloom is off, you have to switch to something else.

Q. What are the opportunities in marketing?

A. If we get away from the defeatist attitude that has recently prevailed, we can educate the public that driving is more than just transportation.

We need to stimulate travel—and Sinclair has emphasized this through its advertising in our series on national parks and Civil War battlefields. There is a lot of our country that is worth seeing, and the best way to see it is by automobile.

High-speed air travel is convenient, but it is no substitute for auto touring. The national-highway program offers an excellent opportunity to open up pleasure driving again. But we need also to reduce the gasoline tax, which is a heavy drag on consumption. A 50% sales tax is a needless burden, particularly when one considers a large part of such tax is diverted from highway purposes into general tax funds.

Q. Do you expect changes in marketing methods?

A. There may be a revolution in marketing. The present method of selling gasoline is archaic. I don't know the answer, but I do know the present way isn't necessarily the right way. Most marketing areas are over-supplied with service stations, with the result that some are bound to have poor returns.

Q. Is the centrally located super station, as opposed to numerous neighborhood outlets, the answer?

A. The centrally located super station has not yet been tried out a sufficient length of time to draw conclusions. Generally, the motorists seem to prefer neighborhood service that is more convenient.

Q. A number of companies have recently reorganized in order to attain more efficient management. Does your company have similar plans to streamline?

A. We consider that our organization is streamlined. Our chairman, Mr. P. C. Spencer, set up the present form of organization several years ago and it has proven eminently satisfactory.

Modifications have been made from time to time but these have been minor. It is the intention to keep the organization flexible to meet changing conditions. We are decentralized to a great extent with each subsidiary planning its own operations. Matters of overall policy, however, are set by the senior management of the parent corporation.

Tunnels Under Field to Tap Pay Above

A WEST VIRGINIA company is starting an unusual secondary-recovery project.

It plans to tunnel under the shallow oil sands, drill holes upward, and let the oil seep downward into the tunnels.

This adaptation of mining practices to oil recovery is being used by Power Oil Co., Parkersburg, in Volcano field, in Wood and Ritchie counties, West Virginia. The field produces from the Big Injun sand at about 300 ft.

The company will decide just where to mine the tunnels once a test well being drilled with cable tools is completed. The operator is taking samples every 2 ft. in the test well.

Work will start in about 30 days on sinking a mining shaft. Tunnels will be dug from the shaft under the pay sand. Power proposes to use mining tools to drill slim holes up into the formation and let the crude flow by gravity into the tunnels. The oil then will be pumped to the surface through the shaft.

A pilot project testing 40 acres is planned. The project will be expanded to cover 600 acres if the pilot is successful.

Power also plans to drill downward from the tunnels. A second producing formation is found at 800 ft.

Shale deposits in Australia have been mined successfully with the method proposed in Volcano field, but this is believed to be the first domestic oil operation to use this technique.

Helium Bill Signed into Law

. . . as several companies show interest in the program for building strip plants. Financing appears certain.

PRESIDENT EISENHOWER signed the helium bill last week, opening the way for construction of plants by private industry to strip helium from natural gas.

If the Government is not successful in getting the plants built by private industry, the Interior Department is authorized to build the necessary plants itself.

Principal opportunities for private-industry participation are in the areas where natural gas contains helium supplies in sufficient proportion to make its recovery feasible.

Currently, such known areas include the Hugoton field of Kansas and Oklahoma and the Panhandle field of Texas. There have also been indications of recoverable quantities in western Colorado, eastern Utah and elsewhere.

Because of the large amount of natural gas that must be processed to recover substantial amounts of helium, it is expected that any private plants will be built by natural-gas pipeline companies serving Kansas and Texas fields known to contain helium.

How it will work . . . Under the new legislation:

The Government will contract to buy crude helium for periods not to exceed 25 years from plants to be financed, built and operated by private industry.

Prices to be paid for the helium will be negotiated between the Government and the company building the plant. Basically, the Government plans to pay enough to enable the company to regain the cost of the plant plus enough to cover all other costs and to return a profit.

What it boils down to, then, is a cost-plus type of operation.

Helium bought by the Government will be in crude form, containing from 50% to 80% helium by volume. This crude helium will be delivered to a pipeline which will move it to government-owned storage in the Cliffside field.

Government-owned plants will continue to produce helium and, when necessary, will recover and purify the stored crude helium for sale to federal agencies and commercial consumers.

There is nothing to prevent a company from building its own plant and selling to commercial consumers without a government contract, but no company has seen fit to try this.

Taking part . . . Interior has reported that several companies have already shown interest in participating in the program. Anyone else who is interested can get full information from the Assistant Director for Helium, Room 4627, Department of Interior, Washington 25, D. C., or from the Office of General Manager, Helium Operations, 514 Barfield Building, Amarillo, Tex.

Interior Secretary Fred Seaton pointed out last week that the terms of the legislation prohibit the signing of any contracts before March 1, 1961. However, this does not bar preliminary negotiations before then.

Seaton also noted that, as yet, Interior does not have funds for the program. The necessary borrowing authority will be sought during the next session of Congress.

Texaco Signs Pact

. . . for 6-year permit to explore all of LL&E's uncommitted lands.

TEXACO INC. and Louisiana Land & Exploration Co. have signed what may be the biggest private land lease deal in Louisiana oil and gas history.

The agreement gives Texaco a three-fourths working interest in 400,000 acres of nonproducing land, mostly in Southeast Louisiana.

LL&E retains a one-fourth working interest and, with additional royalty, will get 40% of the value of any production developed. Texaco gets 60%.

Texaco paid LL&E $3,940,000 cash for the option-type contract, which runs for 6 years.

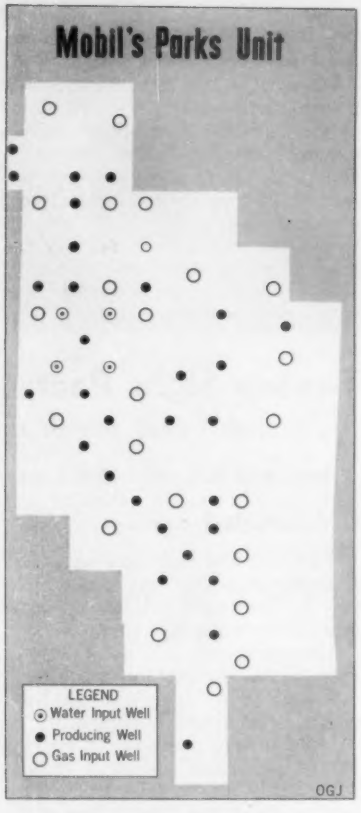
Texaco will be the operator and has agreed to drill at least seven wildcats during the 6 years. At the close of the lease period all interest in nonproducing tracts will revert to LL&E, the fee owner.

LL&E is one of Louisiana's largest land owners, and the 400,000 acres involved in the Texaco deal represents all its fee-owned nonproducing land not being drilled or not under lease to someone else.

Most of the leases are located in the Southeast Louisiana parishes of Terrebonne, Lafourche, Jefferson, Plaquemines, St. Charles and St. John the Baptist. The tracts vary in size, but none is greater than 10,000 acres. Most are in Southeast Louisiana's Miocene trend. A number of dry holes have been drilled on part of the acreage.

Texaco confirmed the signing of the contract last week but did not release details. A spokesman said the New Orleans division of the company will do exploratory work to evaluate the acreage before launching a drilling program.

Mobil's Slug Drive—A Success Story



ONE OF 23 input wells which to date have injected more than 7 million cubic feet of gas.

BUSY TANK has handled 1,540,000 bbl. of propane, was emptied six times on an average day.

• In the Parks field of West Texas, the nation's largest miscible project enters a bright fourth year. There's every indication of a 55% recovery of the oil in place.

Robert J. Enright
District Editor

MOBIL OIL CO. is well along toward proving, in the biggest miscible recovery project yet operating in the U. S., that the LPG-slug type drive can be made to work. And work spectacularly.

Mobil is operator of the unitized operation in the 10,400-ft. Bend reservoir in Parks Pennsylvanian field of West Texas.

The $3,000,000 project involves 5,900 acres of the 8,205 acres productive in the Pennsylvanian within the unit's 8,592-acre bounds. It was one of the country's first slug drives.

Performance has been highly favorable and right in line with the predictions of Mobil engineers before startup more than 3 years ago.

Already the reservoir has produced more oil than was anticipated for its entire primary life without the project. And Mobil engineers predict that the miscible drive will keep adding to recovery for perhaps another 8 years. Eventually total added recovery may more than double total primary oil.

In barrels, the project shapes up this way:

. . . 3,800,000 bbl. estimated as the total recoverable by primary methods.

. . . 4,200,000 bbl. already recovered by primary and secondary operations to July 1 this year.

. . . 11,000,000 to 12,000,000 bbl. estimated as total take—of which 7,000,000 to 8,000,000 bbl. would be due to miscible drive and complementing small water flood.

Findings significant . . . Mobil engineers caution that the project has been operating just a little over 3 years of a probable 11-to-12-year life. There is a long period remaining, they say, in which something unforeseen could affect the project adversely.

So far, however, the slug drive has closely followed predictions based on reservoir model studies. Doyle Marrs, division reservoir engineer for Mobil at Midland, says, "We have seen nothing so far to indicate that our initial forecasts for the project are not still in the ballpark."

The Parks record is good news to the industry, especially since a number of similar projects yielded disappointing results. In most of those cases, trouble was due to quick channeling of the LPG through more-permeable portions of the rock to the producing wells.

No propane channeling . . . The Parks project has experienced seven "breakthroughs." But these were scheduled events and not due to fingering or channeling of the propane.

If project forecasts are on the nose, the Parks miscible operation will recover about 55% or 11,400,000 bbl., of the original oil in place in the Bend reservoir. Oil-in-place is figured at around 20,700,000 bbl. This compares with an estimated conventional waterflood take of about 41% of in-place oil, or around 8,480,000 bbl., and a primary of only 17%.

And the miscible drive will do it faster, reaching abandonment perhaps a couple of years earlier. The saving in time would allow an operator to recoup some of the technique's higher costs.

The favorable early results at Parks played a major role in influencing Mobil to launch the world's largest miscible drive—also an LPG - slug type—in Canada's Pembina field.

Mobil is injecting propane through 10 wells on a 41-spot pattern (one input in the center of 40 producing wells) which will sweep roughly 13,000 acres of Pembina's Cardium sand. The slug drive, together with a surrounding 33,000-acre water flood, will boost total oil recovery from the North Pembina unit to an estimated 366,000,000 bbl. Only about 118,000,000 bbl. could be recovered through primary methods.

What Mobil has learned . . . Marrs says that at Parks "we have learned that this type of miscible drive is a recovery tool that can be made to work.

"And with it we can obtain, where conditions are suitable, more oil than through other techniques now in common use.

"We know we have successfully created an oil bank with a gas-driven propane slug. And there is nothing so far to indicate that we can't maintain it."

However, Marrs adds that the individual case must determine whether

the slug drive is a good investment in any particular pool. Important points include the availability and cost of the LPG, whether the operator can get enough allowable to get the oil out fast enough to warrant making the added investment, and the kind of reservoir.

Mobil engineers attribute the lack of channeling and fingering of the propane to several factors.

One is that the limestone pay is relatively uniform.

Also, Mobil carefully took into account the known permeability variations in planning how much propane to inject and where to inject it. Overall, the company injected enough propane to fill about 4% of hydrocarbon pore space. (This compares with about 7% at Pembina.)

Mobil will report detailed engineering data on planning, operation, sweep-out efficiencies and other vital statistics of the Parks project at the coming fall meeting of the Society of Petroleum Engineers in Denver October 2-5. Marrs is author.

How it stands now . . . Currently, Mobil is injecting a total of about 10,000,000 cu. ft. of gas daily into the reservoir through 23 input wells in a rough peripheral pattern. It is injecting about 1,500 bbl. of water daily in a single five-spot on the west side of the field.

The water pilot was started about 2½ years before the miscible drive and has been kept in use.

The unit now has 32 producing wells, with seven of them temporarily shut in.

Oil production has climbed from a low point of about 325 bbl. daily in early 1957 to a current level of about 1,700 bbl. daily. Average reservoir pressure, which had sunk to a low of about 1,700 psi., now is back up to about 1,910 psi. And the average GOR, which had reached 1,700:1 in early 1957, is back down to a respectable 3,800:1.

Productive capacity is increasing. In the past, low allowables acted as a retarding factor to some extent.

All told, Mobil has injected roughly 1,540,000 bbl. of propane, 6.9 billion cubic feet of gas, and 2,560,000 bbl. of water into the Parks Bend pay. Propane injection was completed many months ago.

Production totals as of July 1—together with the 4,200,000 bbl. of oil—include 24.8 billion cubic feet of gas and 110,000 bbl. of water.

Experience at Parks shows that a carefully engineered project in a suitable reservoir can succeed—and on a scale large enough to make the extra expense worth while.

watching WASHINGTON

Clyde La Motte

• Import officials map new residual fuel plans . . .

OIL IMPORT ADMINISTRATION officials hope to have ready by October 1 some proposed changes in residual fuel import controls.

If so, it will then publish the proposals in the Federal Register and set a 30-day period for getting comments from the industry.

After that, it will decide whether to put the new plan into effect, modify it to meet industry objections, or drop the proposed changes entirely.

If the changes are decided upon, they will probably be made effective for the first quarter of next year.

What the OIA is shooting for is some formula which will combine historic imports with domestic sales to provide a new base for setting residual quotas. This would open the door to some newcomers and would help ease the position of others who now have only small quotas with which to fill large supply contracts.

Current thinking at OIA is that the new plan will be patterned after the one used for crude-oil imports. Thus, an established importer during 1957—the base year—would be assigned a specific percentage and this would be supplemented by a percentage of his domestic sales.

Newcomers would share the remainder, probably based on sales volumes, just as crude-oil quotas are based on refinery runs.

The principal obstacle to this approach is where to draw the line on classification of newcomers who would be eligible. After all, there are a lot of residual fuel sellers. To let them all become eligible would mean that not many would get quotas large enough to make it worth while.

The alternative would be to increase the total of residual imports, but the Interior Department has clearly demonstrated that it wants to hold the level at or near the 1957 import total.

However, OIA is determined to improve the current procedure because it has caused most of its control headaches.

• How far will OCDM go in seeking oil price data . . .

THE OFFICE of Civil and Defense Mobilization may simplify the residual fuel-oil price reporting form it has under consideration.

One point objected to by industry representatives was the requirement in OCDM's original proposal that detailed price information be provided for past years—as far as 3 or 4 years back.

OCDM said it needs such background information to give meaning to current pricing figures and to indicate any trends that may have developed under the control program.

Some company spokesman pointed out that this would be a considerable burden, particularly if it called for a breakdown by years of types of customers, method of delivery, dates of delivery, prices, etc.

Some compromise may be followed. For one thing, OCDM may give companies an extended period in which to provide background statistics. Meanwhile, the companies would continue to supply current price data on a quarterly basis.

• Roosevelt wants to air coercion charges again . . .

REP. JAMES ROOSEVELT (D.-Calif.) has a problem.

He wants to issue a report blasting the majors for alleged coercion of independent service station operators and calling for divorcement of majors from marketing of tires, batteries and accessories.

And he wants to get the report out in time to get some use out of it before the November elections.

But there appears to be little chance that a majority of the full committee which held hearings last winter will agree. And, if so, there will certainly be a strong minority report dissenting.

Facing such a stymie, Roosevelt may have to be content with leaking portions of his report so that he can get some preelection mileage out of it.

First Lomax Unit Going Up

. . . at Powerine's Santa Fe Springs refinery. UOP plant will convert diesel fuel and heavier streams to gasoline.

THE REFINING industry's first Lomax unit, a hydrogenation process which converts diesel oil and lower to gasoline, is being built at Powerine Oil Co.'s Santa Fe Springs refinery in suburban Los Angeles.

Lomax, developed by Universal Oil Products Co., is a pure hydrogenation process which turns out more gasoline than the feedstock, since hydrogen is added to the charge.

What it means . . . Powerine's move is significant. It marks the first commercial application of recently developed techniques for converting heavier petroleum fractions to gasoline by the hydrogenation route.

Severe hydrogenation or hydrocracking has been practiced in the past, particularly in Germany. It was tried briefly in this country prior to World War II, but did not prove practical because of the extreme pressures then required.

Hydrogen treating paved the way for this next step in refining technology. This mild form of hydrogen addition has been widely adopted as a means of removing sulfur and nitrogen compounds, and saturating olefins for greater stability.

New catalysts and methods used in hydrogen treating showed the way to severe hydrocracking at moderate operating conditions. Hydrocracking is regarded by some refiners as the next break-through in processing. This new departure will be required they feel, as future gasoline demand continues to outstrip heating oil demand in annual demand growth.

The unit . . . The 2,200-bbl. unit going in at Powerine's plant will have a yield of 2,537 bbl. daily, a 15% increase over the charge.

The Powerine unit will charge either diesel fuel within the boiling range of 440° to 656° F. or thermally cracked gasoline with a 220° to 425° F. boiling range.

A 3,000-bbl. Platformer also is being added to the Powerine plant, apparently to provide hydrogen for the Lomax unit.

The refinery has two Platformers with combined capacity of 3,200 bbl.

Powerine is an independent refiner with a 15,400-bbl. refinery at Santa Fe Springs. The company also operates a chain of service stations and only recently adopted tetramethyl lead as gasoline additive.

Powerine and Standard Oil Co. of California are the only West Coast companies selling methyl gasoline.

Several new processes . . . Refiners can now choose from a variety of new hydrocracking processes.

In addition to Lomax, the first to be used commercially, are Isocracking, Unicracking, HDS and others. Technically ready, they have been waiting in the wings for the economics of this new type of processing to cue them in.

Murphy Is Buying Markets

. . . as part of a program to prevent surpluses. Merger with Spur planned, National Petroleum is purchased.

MURPHY CORP. has taken two more steps to gain markets for its rising crude production.

The new moves — the planned merger of Spur Oil into Murphy and the purchase of National Petroleum Corp.—are expected to push the company's annual sales volume above the $100,000,000 mark.

These acquisitions are in line with Murphy's corporate aims of gaining direct access to the ultimate consumer of its products, and providing for the growing volume of crude produced by the company.

In the year ended May 31, the company's crude oil and gas liquids production increased 19% from the previous year's total of 11,755 bbl. daily.

The volume of finished products sold in the same period increased by 25% to an average rate of 15,998 bbl. daily. About one-third of the increase is the return from sales in Canada which began in July 1959 with the purchase of Vigor Oil Co. properties in the Toronto area.

The new properties . . . Spur Oil is one of the largest gasoline distributing companies in the U. S. It has approximately 348 stations in a 20-state area extending from New Jersey to Florida on the Atlantic, and westward to Missouri, Arkansas, and Louisiana.

The proposed merger will be considered by stockholders of both companies in future meetings. If approved, the exchange of stock will be on the basis of 7/10 of a share of Murphy common for each share of Spur common.

National Petroleum, with headquarters in St. Petersburg, Fla., is a retail and wholesale marketer. It operates service stations and wholesale terminals in seven counties of Florida. The company's stock was obtained by Murphy for an undisclosed amount of Murphy common.

Murphy has fully integrated operations. Its producing properties are located in the U. S., Canada, and Venezuela. The company's refinery at Superior, Wis., ran an average of 9,274 bbl. daily in the company's last fiscal year, an increase of 13% over the previous year.

School Tax Law

. . . comes up for new test in highest Wyoming court.

Another round is on tap in a court fight over the validity of a Wyoming law which levies a special property tax in school districts without high schools.

Several oil companies have attacked the 5-mill tax as discriminatory.

The Wyoming Supreme Court will hear arguments September 19 on whether the law is constitutional. Sweetwater County appealed to the high court after Sinclair Oil & Gas Co. won a victory against the tax in U. S. District Court.

In the latter action, Judge Glen Stanton ruled the tax is invalid (OGJ, March 21, p. 79).

Sinclair contended the 1959 state law operated unjustly because there are only 13 high-school students in the Bairoil district of Sweetwater County. The company argued in that first court test of the measure that a special tax assessment of $68,878 levied against it was $59,272 more than the amount required to send the students to the nearest school in Rawlins.

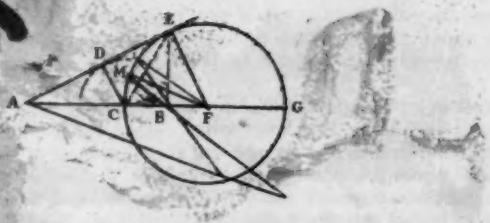
Wyoming has 90 school districts in which high-school students travel to another district (OGJ, Dec. 28, p. 73).

Latest to join the fight against the special levy is Pioneer Pipeline Co. It filed action against Sweetwater County in Stanton's court to recover "taxes illegally levied and assessed" in three school districts of the county. Four other pipeline companies have filed a federal suit seeking to freeze money collected under the law until the Supreme Court rules.

THE QUALITY OF THINKING

The mind of Galileo—keenly analytical, superbly trained—led him to founding the science of experimental physics, which, centuries later, is revealing the mysteries of space. It is self-evident by his achievements that Galileo's mind reached a level of quality far above ordinary standards of excellence.

Within the same area of meaning, the quality of minds responsible for an engineering project can be evaluated only by results. When you check the record of Brown & Root's engineering through the years, the high quality of thinking reveals itself. Customer satisfaction from greater efficiency at lower costs has built a worldwide reputation for engineering and construction by Brown & Root.



"The knowledge of a single fact through a discovery of its causes prepares the mind to understand and ascertain other facts..."
Galileo

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Geologists Told: Quit Ivory Tower and Grow

• A colleague, Humble's Ed Hamner, says rockhounds must become a real part of the team. Even though fewer geologists are needed today, he fears that too many have been pushed out of the field at the college level.

A STRAIGHT-TALKING Houston geologist last week pointed to an alarming drop in the number of college students taking geology and exhorted his fellow geologists to make their profession a stronger force in the oil industry.

Ed J. Hamner, a director of the Humble division of Humble Oil & Refining Co., delivered his gloves-off speech to the Houston Geological Society.

"Exploration in general has never accepted full responsibility for the economy of its operations," Hamner said, "and until it does it will never be accepted by the rest of the industry as a full partner."

"We cannot survive as a profession if we are content to be regarded as a luxury to be offered only when times are good and be put to pasture in other times."

Here are some of the caustic proposals Hamner made to geologists:

... Don't be aloof from other component parts of the company. "The day for the ivory tower approach is gone. Geologists must look up, assert themselves, and above all become a real part of the team."

... Geologists should learn something about economic principles so that, as they advance into supervisory positions, they can back up their geological thinking with sound thoughts on budgets—and the value of the dollar.

... Geologists should move more strongly into reservoir engineering. Their training in interpreting reservoir conditions, complex structures, and fault patterns is generally more thorough than that of petroleum engineers.

... Young geologists should be willing to serve an apprenticeship working in the oil fields. "Geologists of the last decade were on the whole highly disdainful of serving any kind of apprenticeship."

Shrinking enrolment . . . The past 5 years have seen a drastic drop in enrolment of geology students at major universities.

Hamner made a study of enrolment at the universities of Oklahoma, Texas, and Louisiana State. Since 1955 geology enrolment at Texas has dropped 70% and at the others 71%.

Worse still, the number of freshmen and sophomore geology students has dropped an average of 83% in the three institutions.

Ed J. Hamner
. . . wider knowledge needed.

Not so bad—but still discouraging—are the statistics on geology students in graduate schools. Texas has dropped 16%, Oklahoma 26%, and Louisiana State 5%.

While it is true that industry is hiring fewer geologists, Hamner said the "pendulum has swung too far" in the colleges.

"It is strongly feared that too much discouragement has been offered to men who would really like to study the science of geology," he said. "If this decline in enrolment trend continues—and there has been no abatement since 1955—by 1964 the three schools mentioned will be training only a handful of geologists."

Hamner saw a silver lining in the cloudy picture: Today's geology graduates are likely to be more dedicated, capable, and qualified than their pampered predecessors of a few years back.

"Geologic schools all over the country became crowded in the late '40's and early '50's with students, many of whom sought only to prostitute the science for material gain from jobs which they thought to be easy and careers which they thought would be lucrative," he said.

"Few were actually dedicated to the science. The study of geology seemed easier than chemistry, physics, or engineering. Many wanted training periods in major company laboratories in order to equip themselves to go on their own and become rich.

"If there is a lesson to be learned here, it is this: We should never encourage a young man or woman about to enter college and prepare for a life career to study geology, unless we feel he will really dedicate himself to the advancement of the science with a willingness to share any new knowledge with the world."

The declining industry . . . Hamner cited statistics showing the decline in industry operations during the past 5 years. To geologists the decline means "unemployment, layoffs, greatly reduced employment of new geologic graduates, as well as the feeling of job insecurity by many."

Ironically, part of the trouble stems from success.

"We have worked some of our brother scientists out of their jobs," he said. "In the last decade, we have found 36.4 billion barrels of oil in the United States—10 billion barrels more than we produced. Now we find our-

PIPELINE

Sohio Pipe Line Co. plans to build a 3-mile, 6-in. pipeline from its Dayton, Ohio, terminal to the Wright-Patterson Air Force base. The line, to supply jet fuel and avgas, is scheduled for completion November 15.

Buckeye Pipe Line Co. has let contract for a 97-mile, 10-in. product line from Lima to Lebanon, Ohio. The line will enable Buckeye to serve the Dayton-Cincinnati area. Contract for the job, to begin immediately, was awarded to Shamrock Construction Co.

Texas Eastern has been given the green light by FPC for 214 miles of 20 to 36-in. line, a 3,300-hp. compressor station, and two metering stations in Pennsylvania, New Jersey, and Mississippi. The project will cost $40,668,000. At the same time, FPC

selves in a condition of great oversupply. Our ability to produce efficiently is much greater than our demand."

This condition, however, should not prevent companies from continuing their search for oil.

"I should like to strongly urge all companies to retain as much of their exploration manpower as possible and to at least replace attrition with the well qualified young graduates coming on." He concluded: "Failure to explore means eventual liquidation."

SunOlin Building New Plant

A PETROCHEMICAL plant to produce 225 million pounds of ethylene and 55 million pounds of ethylene oxide per year will be built by SunOlin Chemical Co.

Contract for engineering and construction has been awarded to Lummus Co. for the $20-million plant, to be located adjacent to the Sun Oil Co. refinery at Marcus Hook, Pa., which will supply raw materials.

Existing facilities of Sun will be modified to permit production of 12 million cubic feet of high-purity hydrogen and up to 1 million cubic feet of carbon monoxide per day.

SunOlin, jointly owned by Sun and Olin Mathieson Chemical Corp., will use an ethylene process designed by Lummus and an ethylene-oxide process perfected by Shell Development Co.

A multiple pipeline crossing of the Delaware River to New Jersey is planned to move products.

Morgan Davis

Joseph S. Morris

Davis, Morris to Get Awards

TEXAS Mid-Continent Oil and Gas Association's 1960 distinguished service awards will go this week to Morgan Davis, president of Humble Oil & Refining Co., Houston, and Joseph S. Morris, San Antonio independent.

TMOGA annually cites a major-company executive and an independent operator. This year's awards will be presented September 21 at the annual meeting in San Antonio.

Davis, 62, has been with Humble nearly all of his active oil career. He joined the company in 1925 at its old Cisco, Tex., division and became president in 1957.

The 58-year-old Morris heads Allen & Morris Drilling Co. He started in the Texas oil fields in 1920 and worked as a roughneck, driller, and foreman before helping form Allen & Morris in 1924.

Davis has served as president of the American Association of Petroleum Geologists. He has also been active in the National Petroleum Council, Society of Petroleum Engineers and other groups.

Morris is a past president of the American Association of Oilwell Drilling Contractors. He was named to the National Petroleum Council in 1949.

BRIEFS . . .

okayed Algonquin Gas Transmission's plea to build 30 miles of transmission line and 8,000 hp. in compressor capacity in Massachusetts.

Lynchburg (Va.) Gas Co. has been told by an FPC examiner that it can not shelve Atlantic Seaboard in favor of Transcontinental Gas Pipe Line as a supplier. The examiner's ruling backed a previous FPC decision that there is a question of Transco's ability to supply new customers.

Crude-oil deliveries by Interprovincial Pipe Line Co. this month are expected to decline from an August rate of 352,429 bbl. daily to 337,840 bbl. daily. The reasons are a maintenance shutdown of a U. S. refinery and lower crude requirements in Ontario. October deliveries are estimated to be still lower than September because of planned turnarounds of several refineries served by Interprovincial. For the first 8 months of 1960 deliveries are up 8% to 360,623 bbl. daily.

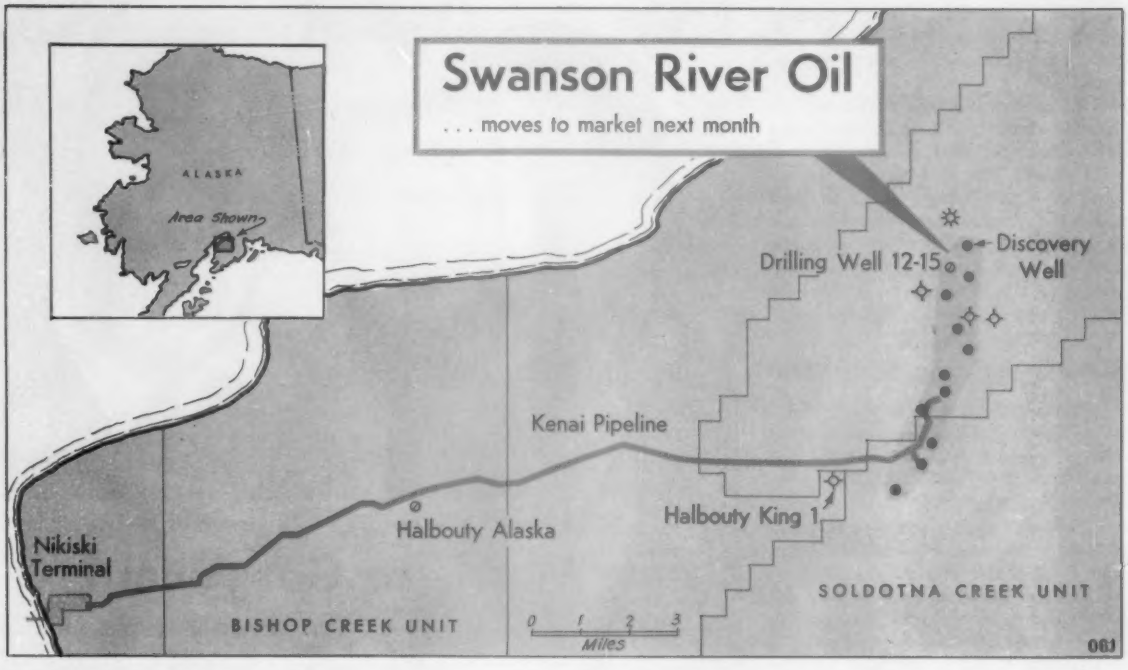
A North Dakota crude gathering system, being constructed for Great Northern Railway, is scheduled to go into operation November 1. It consists of 50 miles of 10-in. and 6-in. connecting Newburg, Wiley, and Glenburn fields in Bottineau County with the railroad's storage and loading rack at Minot, N. D. Contractor is Curran & Co., Great Falls, Mont. Another section of the system, to tap Lignite field, is to be built in 1961.

A Wyoming crude line to connect Barger Creek and Dead Horse Creek fields with terminal facilities in Salt field is planned by Teton Pipeline Co., Denver. Teton has filed its application to construct the 67-mile line of 6 or 8-in. pipe with Wyoming Public Service Commission. Cost of the line is estimated at $1,100,000. Teton proposes a gathering charge of 5 cents a barrel and main-line costs of 35 cents a barrel.

Also for Pipeliners . . .

IN THE NEWS: First flow of oil to start soon over new Alaskan crude pipeline from Kenai fields to new terminal (p. 72) . . . Gas pipeline construction is still a booming business (p. 75).

PLUS THESE TECHNICAL REPORTS: Pipeline to truck in a direct takeoff (p. 92) . . . Cutting turbulence and reducing noise in gas pipelines (p. 125).



Alaskan Oil Starts Paying a Return

• It has been a long, expensive fight to find commercial oil in Alaska. Next month these years of wildcatting will begin to pay off as the first oil moves into the market from Swanson River field on the Kenai peninsula.

Carl J. Lawrence
West Coast Editor

A STEADY flow of crude will start moving out of Alaska next month, marking another milestone in the dramatic oil history of our newest oil state.

Just where the oil will go has not been determined (it probably will end up in California), but the destination of the oil is overshadowed by the fact that Alaskan oil will start returning some of the millions of dollars wildcatters have spent in their search for commercial production.

The crude will be coming from Swanson River field, the Kenai Peninsula discovery of 1957 which kicked off the scramble for leases in Alaska. The field, the state's only commercial oil production, is composed of two pools, Swanson River unit Hemlock pool and Soldotna Creek unit Hemlock pool. Currently, there are 11 producing wells and 3 dry holes in the field. One development well is being drilled.

Kenai Pipe Line Co., an affiliate of Standard Oil Co. of California, is laying an 8-in., 22-mile line from the field to Nikiski, a small town on the Cook Inlet. Standard of California is operator in the field.

The hunt for oil has been going on in Alaska since the turn of the century, but the most concentrated search has been in the last 10 years. And activity hit a peak after Richfield Oil Corp. made its famous Swanson River unit discovery in July 1957 (OGJ, July 29, 1957, p. 107).

Richfield later made a deal with Standard of California on development of the discovery area and the adjoining Soldotna Creek unit. The 71,680-acre Swanson River unit has four participants. Standard of California and Richfield each own 44¾% and Union Oil Co. and Ohio Oil Co. each hold 5¼%. The 70,720-acre Soldotna area is split equally between Socal and Richfield.

Since the discovery of oil on the Kenai, drilling and pipeline operations have faced three obstacles: The weather, the moose, and the trumpeter swan. Cold weather is something any Alaskan operator must face, but the moose and swans are added elements in Swanson River field which is located in the Kenai Moose Range.

The swans are a particular problem. They are nearly extinct and happened to pick this part of North America as their nesting place. A part of the pipeline route was dictated by the location of the nesting lakes of the birds—and work was delayed a month at one time until it could be seen whether the swans were disturbed.

The success Standard of California has had in working in a restricted wildlife area will probably have an important bearing in the future on whether leasing bans covering other game preserves are lifted.

The field . . . Swanson River field will have a daily potential of 5,500 bbl. when the pipeline is completed in October. The wells flow from the Hemlock between 10,000 and 12,000 ft.

Production has been established on a northeast-southwest trend which is approximately ¾ of a mile wide and 5.8 miles long. The eastern limit of the field has been determined in part by SRU 22-23. The westerly limits have been defined by two dry holes, the SRU 34-16 and Halbouty King Oil Co. 1, which was drilled just outside the two units.

One well, SRU 32-10, drilled about a ½ mile northwest of the discovery,

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was dry in the Hemlock, but found gas at 3,950 ft. Shallow gas sands have been found elsewhere in the field, but no plan to develop the gas has been announced.

All drilling in the two units has been in only seven sections, so much of the area is still to be explored.

Development . . . Swanson River may eventually become a fully automated field.

Several cost-cutting ideas are going into the field. And the minimum of manpower and equipment is even more desirable in Alaska due to the inclement weather. The field also is being developed on wide spacing with the first wells being drilled on a 160-acre pattern.

Positive-displacement LACT units will handle the crude as it moves into the pipeline from the field gathering system. And positive-displacement meters will be used in transferring the crude from the wells to the gathering system.

All lease equipment has been designed with the idea of later switching to full automation in the field.

Several precautions have been taken to prevent the crude from freezing once it reaches the surface. The 3-in. gathering system will be buried 42 in. below the surface where temperatures are expected to remain at 32° F. or above. The only alternative to the buried lines would be heated lines, which Socal hopes to avoid.

Flow and gathering lines are being equipped with scraper traps so that waxing can be controlled with hard rubber balls, which will be run through the lines. Christmas trees will be equipped with high-low pressure controls which will permit any group of wells on a lease to be shut in from the trap inlet header.

Gathering headers and circulators will be equipped with special hot-oil circulating connections to aid in wax removal. And all gas-metering facilities will be housed to protect them from freeze-ups during the severe weather.

Since the field is on the game preserve, all waste water must be injected into the formation. One injection well is now in use and another is planned.

Pipeline . . . Alaska's weather has been a big factor in how the 18½-mile pipeline is being laid and designed.

The warm weather during the summer thawed the muskeg which made the use of some heavy pipeline equipment prohibitive. Some of the pipe was strung along the right-of-way by helicopter to avoid the use of heavy equipment.

But the big bugaboo for the pipeliners has been the cold weather. This has affected virtually every phase of the pipeline from the wellhead to the tanker terminal.

There is little doubt that the pipeline will be moving crude at temperatures below the pour point of the oil during some of the severe winter weather.

The line also will be buried 3 ft. in order to maintain as high an oil temperature as possible.

Normal winter pumping pressure is expected to be 480 psi. and summer pressure 170 psi., but the line will have a maximum discharge pressure of 825 psi. in order to move the crude during the cold weather and keep it from solidifying in the line. Ultimate design discharge pressure will be 1,620 psi.

The Kenai line will have an initial capacity of 10,000 bbl. daily and an ultimate capacity of 35,000 bbl. daily with additional horsepower and tankage. There will be two 4-in. feeder lines to the main line. One will run north to Swanson River pool and the other south to Soldotna Creek pool.

The only pump station will be near the Soldotna Creek feeder point. The station will be remotely controlled from the tanker terminal at Nikiski.

J. Ray McDermott Co. is laying the line for Kenai Pipe Line.

Terminal . . . The terminal at Nikiski will be able to handle tankers up to 28,000 deadweight tons and will have an hourly discharge capacity of 15,000 bbl. It will be open throughout the year—thanks to some of the cold-weather features built into the equipment.

Here are some of the things being done to keep the oil from freezing:

. . . Heaters will be installed on the two 132,000-bbl. tanks to keep the oil temperature at 40° F. A 20,000-bbl. ballast-water tank also will be heated to keep the water at the same temperature.

. . . Propeller mixers will be built into the oil tanks in order to keep wax in solution.

. . . The 24-in. crude loading line from the tankage to the wharf causeway will be continually circulated with a crude-oil stream to prevent freezing. An 8-in. circulating line will run from the tank field to the start of the causeway. A 10-in. line from the ballast tanks will be designed for draining and all other lines, where draining is not practical, will be steam or electrically traced.

Other activity . . . As the finishing touches are being put on the Kenai pipeline, the hunt for Alaska's second commercial oil field is going on.

Four wildcats currently are drilling and a development program is getting under way in the state's only other commercial producing area, a gas field 20 miles southwest of Swanson River. Union and Ohio, the two minority partners in Swanson River unit, have staked location for three wells in their Kenai unit field, which now has three producing gas wells.

A gas line is being laid from the Union-Ohio field to Anchorage.

Halbouty Alaska Oil Co. is drilling two wildcats in Alaska, both on the Kenai. One test is 10 miles west of the most southerly Swanson River well and the other 9 miles south of the well.

Richfield is nearing the projected depth of a deep wildcat it is drilling in the Cape Yakataga area and Colorado Oil & Gas Corp. is below 4,800 ft. on its 8,500 ft. test in the Cape Fairweather area.

The Richfield test is in the same general area of the old Katalla field, which produced about 154,000 bbl. of oil from 1914 to 1933. Katalla was Alaska's first commercial oil field, but it was small compared to Swanson River. It took Katalla almost 20 years to produce what Swanson River can turn out in 31 days.

About 450 miles west of Anchorage, Pan American Petroleum Corp. is conducting an exploration program in the Napatuk Creek Development Contract unit, to the west of the town of Bethel.

Pan American has 11 partners in the unit. As operator, it is moving a rig by barge from Seattle and may start a test later this year.

Several other companies may start wildcats in Alaska this winter and there is a chance Standard of California and Richfield may explore some more of the acreage in the two units. But right now Socal and Richfield are concentrating on keeping the wildlife happy and the oil flowing from their new field in the Kenai Moose Range.

It's 8 Days Again!

FOR the sixth month in a row, Texas will be held to 8 producing days in October.

Last week the Texas Railroad Commission fixed the month's initial allowable at 2,630,576 bbl. per day. This is 14,730 bbl. per day less than the initial figure in September and 47,644 less than the one in effect September 10.

This action continued the commission's obvious attempts to reduce the surplus of products by tightening up the supply of crude available.

Four Cars Roll on Mobil's Treadmill

CARS SPEED as high as 100 miles an hour without moving an inch at Socony Mobil Oil Co.'s new highway simulator laboratory in Paulsboro, N. J.

Road conditions are simulated by a magnetic tape record of a car's trip over a highway. The tape records throttle positions, speeds, road grades, stops and starts. When the tape is played in the control unit it can "drive" four cars in an identical manner simultaneously. This enables the company to test the performance of experimental grades of gasoline and oils under identical driving conditions.

Texas CO_2 Flood Is Approved

HELMERICH & PAYNE, Inc., Tulsa, hopes to launch next month Texas' first carbonated-water flood.

The company last week won approval of the Texas Railroad Commission for its planned flood project in the Queen sand reservoir under 1,170 acres of the White & Baker field of Pecos County in West Texas.

The first phase of the program, involving only about 180 acres, is expected to cost roughly $380,000.

Operator calculates that the carbonated flood will enable it to produce about 2,000,000 bbl. of oil that it could not otherwise recover—even with a conventional flood already under way.

The 1,750-ft. Queen sand pay has proved a tough customer for conventional secondary-recovery methods. Gas injection was employed from August 1947 to January 1954 through 4 input wells with indifferent success.

A conventional waterflood was launched in 1957 and is still in operation. But injection troubles have stymied input of more than a third of the needed water volume. Much of this trouble has been laid to bacterial growth and swelling shale in the pay sand. The CO_2, operator thinks, will cut down on bacterial growth and tend to dehydrate the shales.

The injection plan . . . Leases involved in the project are the Lowery & Wilson D and the White & Baker A, B, E, L, M, and N tracts.

There currently are 55 producing wells in the pool averaging only about 3 bbl. daily each. Cumulative production from leases to be flooded totaled nearly 3,000,000 bbl. to June 1 this year. Total water injected to July 1 through six input wells was 560,000 bbl.

Helmerich & Payne, as operator of the project, plans to obtain compressed carbon dioxide in liquid form from a liquefaction plant to be built by West Texas CO_2 Co., formed recently by Helmerich & Payne and Oil Recovery Corp. (OGJ, July 11, p. 64).

The liquid CO_2 will be moved via tank trucks from the plant in Puckett field, also in Pecos County, to the field where it will be stored in tanks until used. The gas and water will be injected through 16 wells on a 20-acre, five-spot pattern.

Input wells will be equipped with two strings of tubing—one for the gas, another for the water. Mixing will take place at the sand face.

Helmerich & Payne's partners in the project are American Petrofina Co. of Texas and Oil Recovery Corp., which owns the carbonated-water ORCO process.

Natural-Gas Lines

. . . still spreading across nation at record pace.

ALTHOUGH natural-gas pipeline networks already reach into every major area of the nation, construction of gas transportation facilities is continuing at a record pace.

A report made last week by the Federal Power Commission bears this out.

In the 1960 fiscal year, which ended June 30, the FPC authorized construction of more than $846 million in new interstate gas transmission facilities.

This included authorization for nearly 9,400 miles of pipeline.

Both of these totals—value and mileage—set new records.

By comparison, FPC approvals in fiscal 1959 authorized 4,893 miles of pipelines and other facilities costing a total of $763 million.

Five years ago, facilities costing $465 million, including 4,927 miles of pipeline were approved.

In 1950, the FPC authorized 6,188 miles of lines and other facilities costing $487 million.

The largest single certificate authorization during fiscal 1960 was issued to Transwestern Pipeline Co. for a Texas-to-California system. This 1,809-mile project will cost about $190 million.

The over-all capacity covered by the 1960 certificates will add slightly more than 3¼ billion cubic feet to the nation's transmission system capacity.

Furthermore, according to FPC Chairman Jerome Kuykendall, the industry will be able to supply its customers better because of increased underground storage in market areas, addition of greater gas reserves to assure continuity of supplies, and modernization of facilities.

Oil-Heating Market Brightens

. . . as petroleum industry rises to challenge through development of new devices for homes and businesses.

THE "middle-of-the-barrel" market, hard hit by natural-gas inroads, has a silver lining that is beginning to show.

It is the result of the boot-straps effort of the petroleum industry to strengthen and expand the market for heating oils and other middle-distillate products.

This optimistic view was presented at the National Petroleum Association annual meeting in Atlantic City last week. Two speakers, R. L. Weeks of Esso Research & Development Co., and R. P. Gilmartin of Gulf Oil Corp., told a manufacturing session about the many projects undertaken in the past 3 years and the progress being made.

New oil burner . . . One cause for optimism is the progress made in developing new oil burners. In less than a year new types of domestic - oil burners may be available, Gilmartin said.

One type described makes use of the air-aspirating principle and consists of an atomizing nozzle, a flame-tube holder, and a small air pump. Developed by Gulf, it has been tested in gas-fired furnaces, hot-water heaters, and in year-round air conditioners.

Work being sponsored by the API likewise is showing real progress toward better oil-burning devices, Gilmartin said.

A major development in strengthening the oil-heating market is the use of hydrogenation in the manufacture of No. 2 heating oils, Gilmartin said. Direct benefits include reduced sulfur and carbon, and the oxidation of unstable, sludge - forming hydrocarbons.

In addition to being cleaner burning, hydrogenated No. 2 heating oil reduces burner service, he said, adding that "actual field performance of the new heating oil over the past 3 years clearly indicates that superior performance is being obtained."

New markets needed . . . Need for developing more markets for the oil industry's vast producing capacity is causing oil-company research departments to explore many new fields, Weeks brought out.

As examples of the progress being made toward new uses, he cited:

An oil-field snow melter, which will be installed at La Guardia Air Terminal.

An oil-field air conditioner is now on the market. The entire unit can be installed to provide both heating and cooling.

An oil-fired crop drier is now well on the way and will be of substantial value to the farmer.

Another area for possible expansion is thermoelectricity. As Weeks pointed out, "Here we may be able to take a simple piece of oil-heating equipment and provide electricity or refrigeration any place we desire."

A cheaper, better oil burner is the key to many new middle - distillate uses, Weeks declared. Competition with lower-cost gas in the home-heating market requires that new principles be used in the burner design. Possible techniques which could be applied are prevaporization, a new atomization method, misting or fogging, and catalytic combustion.

Shell Is Developing Powerful Fuel Cell

A SIGNIFICANT step in fuel-cell research has been made at Royal Dutch-Shell's Thornton Research Center at Cheshire, England.

Dr. C. G. Williams, director and general manager of Shell Research, Ltd., says a low-temperature fuel cell that can generate from three to five times more power per unit volume than other similar cells is under development at Thornton.

"Shell's interest in the fuel cell stems from the fact that the oil industry is a supplier of fuels, and no one has yet decided just what kind of fuel will best suit the fuel cell of the future," he said.

The Thornton cell can operate with either alkaline or acid electrolytes. Hydrogen has been used as the fuel so far, but experiments have shown the cell can use other types of fuels. Further work will be carried out in this direction.

Dr. Williams attributes the high output of the Thornton cell to fundamental studies of fuel cell electrodes which have led to the development of highly active electrodes that are inexpensive and easily fabricated.

When run on hydrogen and oxygen at 3 psi., current densities of 70 amp. per square foot can readily be obtained with either alkaline or acid electrolytes at room temperature. If air is substituted for oxygen, there is little change in performance.

Output doubles as the cell warms up to 140° F.

The research center has constructed multiple fuel cells with up to six cells per square inch, and it is believed that units having a power-to-weight ratio of 50 watts per pound are possible.

Shell believes its research shows real advances in fuel cell design are possible. For the time being, however, the center does not plan to build larger units.

The significance of a practical fuel cell will be that by converting fuel directly to electricity, heat waste is reduced to 20-30%. Automotive-type engines waste 60-85% of the fuel energy in heat.

Even a Winner May Not Pay Off

LYNDON JOHNSON has Texas oil men in a political sweat.

The Texas senator, considered a friend of oil, is running for two offices: Vice president on a Democratic ticket headed by Sen. John Kennedy and pledged to trim the depletion allowance. And for reelection to the Senate, where he is the powerful majority leader.

The Republican presidential team of Nixon-Lodge has a distinct appeal to oil men because it favors keeping the allowance as is.

The dilemma: If oil men support the Nixon-Lodge ticket and it wins, Johnson still will be in the Senate able to get sweet revenge.

If oil men support Kennedy-Johnson ticket and it loses, the Republicans would not feel obligated to oppose the foes of depletion allowance.

If Kennedy-Johnson should win with oil's support, Johnson would lose his powerful job in the Senate where he has been able to stall off attacks on the allowance. Instead he would be the presiding officer tied to a pledge to change the allowance.

Texas oil men ask: Can we win at all this year?

There'll Be No Flood of LPG in Canada

• That's the conclusion of Stanford Research Institute after comprehensive study of supply and demand.

Propane (Thousands of barrels daily)

	1960	1963 Min.	1963 Max.	1965 Min.	1965 Max.	1970 Min.	1970 Max.
Supply	6.0	10.8	10.8	12.1	17.1	14.0	31.1
Potential demand							
Canadian markets							
Alberta	4.0	6.4	6.4	9.1	9.1	13.0	13.0
Other western Canada	1.7	4.1	4.1	6.1	6.1	10.9	10.9
Eastern Canada	0.3	0.3	0.3	0.6	0.6	1.5	1.5
Total Canada	6.0	10.8	10.8	15.8	15.8	25.4	25.4
Export markets							
Northwestern states*	0.5	0.6	1.8	0.6	2.0	0.6	2.0
North Central States†	0.9	2.0	5.0	3.0	6.0	4.0	7.0
Michigan	0	0	1.5	0	2.0	0	4.0
Illinois and Indiana	0	0	0	0	0	0	0
Ohio and western New York	0	0	0	0	0	0	0
Total exports	1.4	2.6	8.3	3.6	10.0	4.6	13.0
Total potential demand	7.4	13.4	19.1	19.4	25.8	30.0	38.4

Butane (Thousands of barrels daily)

	1960	1963 Min.	1963 Max.	1965 Min.	1965 Max.	1970 Min.	1970 Max.
Supply	5.3	12.0	12.0	13.5	17.2	14.5	26.9
Potential demand							
Canadian markets							
Alberta	2.7	3.2	3.2	3.6	3.6	4.9	4.9
Other western Canada	1.0	1.7	1.7	2.4	2.4	4.9	4.9
Eastern Canada	0.1	0.1	0.1	0.6	0.6	7.2	7.2
Total Canada	3.8	5.0	5.0	6.6	6.6	17.0	17.0
Export markets							
Northwestern States*	0.5	2.5	2.5	3.7	3.7	5.7	5.7
North Central States†	1.0	1.3	1.3	3.0	3.0	7.8	7.8
Michigan	0	0	0.8	0	1.0	0	1.5
Illinois and Indiana	0	0	4.9	0	6.0	0	11.8
Ohio and western New York	0	0	5.8	0	8.8	0	17.3
Total exports	1.5	3.8	15.3	6.7	22.5	13.5	44.1
Total potential demand	5.3	8.8	20.3	13.3	29.1	30.5	61.1

Pentanes-plus (Thousands of barrels daily)

	1960	1963 Min.	1963 Max.	1965 Min.	1965 Max.	1970 Min.	1970 Max.
Supply	16	57		70		80	
Potential demand							
Canadian markets							
Alberta	6	15	15	20	20	30	30
Other western Canada	3	5	10	10	15	10	15
Eastern Canada	0	0	5	0	10	0	20
To general crude streams	5	7	7	8	8	9	9
Total Canada	14	27	37	38	53	49	74
Export markets‡							
Northwestern States*	2	10	15	10	20	10	30
North Central States†	0	5	10	5	15	5	20
Michigan	0	5	10	5	15	5	20
Illinois and Indiana	0	10	30	30	50	50	70
Ohio and western New York	0	10	20	20	30	30	40

*Oregon, Washington, Idaho, and Montana. †Minnesota, Wisconsin, and North and South Dakota. ‡These estimates represent potential markets. Since the supply is not sufficient to serve all these markets, no total is shown.

FEARS that a glut of natural-gas liquids will develop in western Canada are belittled in a Stanford Research Institute study.

Some figured the advent of huge gas exports to the U. S. would pile up a vast surplus of gas liquids (OGJ, July 18, p. 57). But the institute, in a detailed study of the supply and demand picture for western Canadian gas liquids from 1960 to 1970, found far more bright spots than question marks.

In its study, requested by British American Oil Co., Ltd., the institute concluded:

... **All propane output** of plants in western Canada should be consumed in Canada through 1970, except under conditions of maximum production. Export markets should be more than adequate to absorb any surplus.

... **A butane surplus** ranging from 7,000 bbl. per day in 1963 to 9,900 bbl. per day in 1970 may be available for export under maximum-output conditions. And, export markets could take care of this.

... **The pentanes plus** (mostly condensate) should be pretty well absorbed by the Canadian market. By 1970 the development of the eastern Canadian market could account for the total production.

The institute used maximum and minimum figures for both supply and demand.

For supply estimates, minimum production was set by pipeline specifications for hydrocarbon dew point. Maximum figures were limited by the lowest B.t.u. rating the transmission company would allow.

Production of liquids from plants existing or actually planned was based on residue gas demands from the various fields of western Canada as estimated from data filed with the National Energy Board.

Liquid production from gas sales above those already under contract was estimated from averaged gas analyses and gas-reserves figures. These were obtained from the Alberta Oil and Gas Conservation Board.

Refinery production of propane and butane also was considered for the supply-demand balance. Refineries are large producers and users of these

products and form an important part of the over-all picture.

Here are the institute's principal conclusions:

Propane . . . Demand in western Canada for propane is expected to increase rapidly—from 5,700 bbl. per day in 1960 to 23,900 bbl. per day by 1970.

The relatively small demand shown for eastern Canada (see table) is a reflection more of a limited supply than a limited market. There's a greater potential market for propane in this area, and it could be served from western Canada if supplies were available.

Butane . . . Production of butane from gas plants in western Canada is expected to jump from 5,300 bbl. per day in 1960 to between 14,500 and 26,900 bbl. per day in 1970.

Maximum supply conditions would leave some surplus to be exported by 1963. It doesn't appear that any market studied will have enough butane deficit to absorb all the export quantities that would be available. But it seems that fairly small markets can be developed in each market area.

Pentanes plus . . . Supply of pentanes plus in western Canada is expected to catapult from 16,000 bbl. per day in 1960 to 80,000 bbl. per day in 1970.

In this case, no range of production is given because natural-gas pipeline specifications require the removal of nearly all pentanes plus. Most of this production is in condensate rather than natural gasoline, and apparently there's substantial interest in condensate in practically all refining areas studied.

The total surplus available for export is expected to stay fairly constant in the range of 15,000 to 30,000 bbl. per day up to 1963. This surplus could be disposed of at current prices for condensate in western Canada without much difficulty.

Generally, it appears possible to dispose of the surplus in refining areas now served by crude-oil pipelines from western Canada.

Liquid Gases May Fuel Jets

. . . of the future. One big advantage: They could cool wings and engines heated by friction in faster flight.

LIQUEFIED methane and propane may be needed to fuel the jets of the future.

The built-in cooling they can provide may be necessary, for as jets fly higher and faster, the problem of heat dissipation becomes more and more difficult. Liquefied gases would absorb the excess heat from the engines and leading edges of the plane before being consumed as fuel.

This ahead-of-the-times viewpoint was presented last week in a jet-fuels symposium of the American Chemical Society in New York. The speaker was R. R. Hibbard of the National Aeronautics and Space Administration, Cleveland.

Heat rejection problem . . . This is already experienced in certain flights with current jets, Hibbard says.

The most efficient way to solve the problem is to transfer the heat into the fuel. In some instances, however, temperatures in the lube oil-fuel heat exchanger have become so high that gummy materials form in the fuel. These gums foul the exchangers and clog fuel-injection nozzles.

Present turbojet planes reject 150 to 200 Btu. to each pound of fuel, Hibbard says. This heat is easily dissipated to the air at subsonic flight speeds, or is transferred to the fuel.

Future jets may need fuels with greater heat-absorbing capacity or "heat sink." Conventional kerosine fuels of the JP-4 type provide a sink of only some 165 Btu. per pound. Highly naphthenic kerosine fuels and aviation-grade gasolines can absorb some 500 Btu. per pound, Hibbard's studies show.

If more cooling capacity is needed, low-molecular-weight hydrocarbons may be the answer. Liquefied methane, or natural gas, can provide a heat sink of more than 1,000 Btu. per pound. Liquefied propane and ethene can absorb more than 700 Btu. And they can do so, Hibbard says, without any penalty in performance or direct operating costs.

Performance . . . His studies show the flight range obtainable with liquefied gases is slightly greater than that with conventional fuels, provided the aircraft are designed for the fuel.

The greater range is a result of the increased heat of combustion of the low-molecular-weight fuels which more than compensates for their low density. The normally gaseous fuels would all give burning characteristics equal to or better than current jet fuels with liquid injection.

Problems of cooling the natural gas to a liquid, and keeping it that way in tanks on the ground and in the plane are formidable but not insurmountable, Hibbard declares.

External icing of fuel tanks may also be a problem. Insulation will be no particular problem; a ¼-in. thickness of newer insulating materials would keep the fuel liquid.

More Fuel Lines

. . . will soon be serving Air Force Bases.

PRODUCTS LINES, which now cut Air Force fuel delivery costs an estimated $3,766,000 a year, will soon link six more bases to their supply source.

One new system, a 6-in. line to K. I. Sawyer AFB, Mich., is due for completion about December 1. When it goes into operation there will be a total of 24 lines, constructed and operated by private industry, serving Air Force facilities.

The Sawyer line is being laid by Gustavson Oil Co. of Escanava, Mich. It will be able to deliver 600-950 bbl. per hour of JP-4 fuel.

Five other bases have approved pipeline proposals. They are Mountain Home, Idaho; Walker, Tex.; George, Calif.; Nellis, Nev.; and Wright-Patterson, Ohio.

Lines already in service range in size and capacity from a 3-in. avgas line which can deliver 150 bbl. per hour, to a 10-in. line which handles 2,500 bbl. of JP-4 per hour. The 23 lines reduce average delivery cost per gallon from 1.5 to 0.9 cents.

PROCESSING

Retarding tank corrosion through the use of coatings and paints is successful enough to deserve continued experimentation, according to a study just published by the American Petroleum Institute. The method hasn't been used enough to prove itself, but results indicate that it will.

Updated standards on meter installations, meter provers, and other meter operations are covered in a new publication of the API. The new volume—API Standard 1101, "Measurement of Petroleum Liquid Hydrocarbons by Positive Displacement Meter"—supersedes the 1952 Code 1101.

A new antiknock compound called "Tetramix" is being produced in commercial quantities at Du Pont's Deepwater Point, N. J., plant. It contains

Hess Confirms Gulf Purchases

- Two subsidiaries created, further expansion planned in Mississippi. Citronelle crude not involved in sales.

PURCHASE of certain producing, pipeline, and terminal properties of Gulf Oil Corp. and Gulf Refining Co. in Mississippi and Alabama has been confirmed by Hess Trading & Transport Co., Inc., Perth Amboy, N. J.

Leon Hess, chairman of the company, also announced plans to expand further in the Mississippi area.

The properties involved include 3,000 bbl. daily of crude production in Eucutta field, Wayne County, Mississippi; a 152-mile 10 and 14-in. crude line from Eucutta to Mobile, Ala.; and a tanker terminal at Mobile.

The Hess purchases concern Citronelle field in only one aspect: Citronelle crude is continuing through the Hess-acquired terminal at Mobile to other buyers.

A previous report (OGJ, Aug. 15, p. 86) stated that Hess would have first call on this crude. Citronelle producers are not now selling crude to the Hess organization and do not plan to do so.

Hess Production Co. and Hess Pipeline Co., subsidiaries of Hess Transport & Trading, with headquarters in Laurel, Miss., will operate the field and pipeline. Floyd L. Martin will be president of both Hess subsidiaries.

Hess Terminal Corp., a third subsidiary which owns and operates tanker terminals in Houston and New Orleans, will operate the Mobile terminal.

Pure Reorganizes Its Exploration Setup

PURE OIL CO. is reorganizing its exploration activities by establishing 9 area exploration offices to replace 21 district offices. The consolidations will be completed by October 1.

"In effect, we are concentrating our efforts where prospects are best for finding oil," said Harris VanZant, Chicago, vice president of exploration and production. The company revamped its producing offices last January.

New area managers will be: Durango, Colo., James Cloninger; Casper, Wyo., Edward Spiegel; Oklahoma City, C. E. Barnes; Newark, Ohio, Larry Smith; Houston (offshore area), Edwin Fritz; Houston (inland area), John Perkins; New Orleans, K. T. Smith; Midland, Tex., Joseph Luckett; Roswell, N. M., Marvin Mace.

District offices formerly were located in each of the nine cities.

Other district exploration offices which will close are at Shreveport, Lafayette, La., Tyler, San Antonio, Corpus Christi, Abilene, Bismarck, Billings, Denver, Ardmore, Okla., Wichita, and Amarillo.

Many of the more than 100 employes involved will be transferred to area offices. Over-all exploration personnel, however, is being reduced, and some will not be replaced.

LPG Miscible Flood

- . . . is planned in South Texas' Rincon field.

CONTINENTAL OIL CO. sought Texas Railroad Commission approval last week of a small miscible flood in the Frio A-1 reservoir in Rincon field, Starr County, Tex.

Conoco engineers said studies indicate that the planned LPG-slug-type miscible drive will hike total recovery from the anticipated primary take of 17% of in-place oil to an ultimate 45%—a bigger estimated yield than from any other known process.

Conoco plans to inject about 25,000 bbl. of propane through 2 input wells into the pay of the 126-acre reservoir. This is about 5% of hydrocarbon pore space.

The company expects to recover roughly 118,500 bbl. of secondary oil or an added 28% of the 423,000 bbl. estimated as originally in place. It bases its calculation on an areal sweep efficiency of 80% and a vertical coverage of 56% of the pay.

So far the pool has given up only 32,070 bbl. of its oil—or about 7½%.

BRIEFS . . .

tetraethyl and tetramethyl leads and mixed methylethyl-lead compounds. Laboratory and road tests indicate desired road octane levels can be achieved more economically with the new additive than with many other lead compounds.

Initial gas gathering and processing started last week in the McComb field, Mississippi, gasoline plant of Sun Oil Co. After recovering natural gasoline, butane and propane, Sun will deliver compressed dehydrated gas to Transcontinental Gas Pipe Line Corp. Initial deliveries are about 4 to 5 million cubic feet daily. Casing-head gas in the field was previously flared.

Tidewater will get into the retail marketing of LPG if a proposed purchase of Vangas, Inc., Los Angeles, is completed. Tidewater is offering to pay $18 a share for Vangas common and $54 a share for Series A preferred stock. Tidewater wants to purchase 251,000 shares of common stock or the equivalent, which would give it 51% of Vangas stock.

Tetramethyl lead is becoming more widely used as an antiknock compound, Ethyl Corp. said last week in announcing a minor price cut. The new price is 90 cents per pound, down 4 cents from that set last spring when the new compound was commercially introduced. Price of its TEL compounds is unchanged, ranging from about 95 to 65 cents per pound.

A benzene plant with a capacity of 30 million gallons annually will be built at Beaumont, Tex., by Mobil Chemical Co. The company estimates that production from the plant, which will include toluene, will begin in about 16 months.

Also for Refiners . . .

IN THE NEWS: This year's oversupply of gasoline is no sudden occurrence—it's been happening now for 7 years (p. 61) . . . First commercial Lomax unit will be constructed by UOP for Powerine near Los Angeles (p. 68) . . . Liquid gases may power jets of the future because of their cooling ability (p. 78) . . . Stanford Research Institute finds there'll be no big surplus of gas liquids in Canada in next 10 years (p. 77).

PLUS THESE TECHNICAL REPORTS: Use of glass-reinforced plastic pipe may increase (p. 96) . . . Cooling-tower parts are made of polyethylene (p. 100) . . . First packaged CO boiler is installed (p. 102).

Unity Meeting Held by Middle East Officials

• Producing countries, stung by recent crude price cuts, seek to unify their opposition at a Baghdad conference. Venezuela's Perez Alfonzo makes another call for converts to a world-wide system of proration.

SLIGHTLY built, balding, and almost owlish as he peers through tinted horn-rimmed glasses, a fervent missionary flew from Caracas to Baghdad last week eager for another chance to sell his world-wide oil proration message to the Arabs.

Just how successful he was remains to be seen, but Juan Pablo Perez Alfonzo, economist-trained Venezuelan oil minister, found fertile ground on which to sow his international oil compact scheme.

He met in Baghdad with disgruntled Arab officials from countries who—with Venezuela—control more than 75% of the world's available oil supply.

Smarting under the sting of the recent round of revenue-price cuts on Middle East oil, Arabs hurried to Baghdad at the invitation of the Iraqi Government. Forgotten for the moment was their outraged indignation at neighboring Moslem, but non-Arabic, Iran which publicly acknowledges the official existence of hated-Israel. Oil-producing Iran also attended the Baghdad meeting.

The whole point of it all for the Venezuelan - Arab - Persian delegates was to form a solid front and force the companies which produce their oil to back away from the recent price reductions and agree to make no future cuts without first consulting them.

In view of the political and nationalistic differences in the group, it is an ambitious project. But, faced with reduced income, the divergent group is today more solidly aligned than ever before.

Soviet pricing patterns . . . Since one cited reason for the Middle East price cuts was increased movement of cheap Russian oil into markets normally supplied by free world producers, Perez Alfonzo said he'd like to talk prices with the Russians, too. He divulged before leaving Caracas that he had just made a trip to Mexico to talk to Soviet officials there about Russian pricing practices.

The Russians in turn suggested that the Venezuelan minister might find it profitable to visit Russia to talk about the matter further. This, he said, he may do on this trip or at another time.

He contends that if, as many believe, the Russians sell their oil cheaply for political advantage, they do more harm than good to the world's underdeveloped countries.

He has never gone so far as to say that Russia would be invited to participate in his planned international oil compact, but has said before that as oil producers, the Russians should have an interest in such a movement.

The Venezuelan minister insists that some international cooperation among oil producers is essential to avoid "continued waste of a basic energy source such as oil." This waste, Perez Alfonzo insists, is just as detrimental to consumers as it is to producers.

"Venezuela recognizes," he says, "that the reduction of prices and the fight for markets are of immediate advantage to the consumers in whose name they are made," but at the same time the most important question is the long-range results.

"This manner of free competition will in the long run cause greater harm to consumers since it exhausts in an irreplaceable resource more rapidly than necessary, and at the same time limits incentive to search for new reservoirs.

"If this should occur, in the near future consuming markets would have to purchase oil at much higher prices."

The most influential Arab oil official who shares the Venezuelan minister's views is Shaikh Abdullah Tariki, Saudi Arabia's Director General of Petroleum Affairs.

Texas-educated Tariki, who has long advocated Arab cooperation in the face of a noticeable lack of Arab enthusiasm for the idea, was elated at the fact the Iraq meeting was called. He said in Baghdad he thought it was highly significant that Iraq called the meeting and it was being held in Baghdad. Iraq did not attend last year's Cairo Congress because at the time, she was at political loggerheads with Egypt, the host nation.

Tariki's theory is that the Arab producing nations, plus Venezuela and Iran, can operate from a position of power and literally force the oil companies to do their bidding—if they agree on a course of action among themselves.

Who was there . . . Attending the Baghdad meeting was just about as influential a governmental oil group as the Middle East has ever seen under one roof. It included the entire seven-man Iraqi delegation which has just had a super-secret series of negotiations with Iraq Petroleum Co.

The group includes Dr. Talat Shaibani, Iraqi Minister of Planning and acting Minister of Oil; Abdul Latif Shawwaf, Minister of Commerce; Mohamed Hadid, former Minister of Finance; Abdul Fattah Ibrahim, head of the General Petroleum Authority; Madhim Zahawi, director of the Cen-

OPEC Aims to Stabilize World Prices

OIL-PRODUCING nations have organized to preserve stable crude prices throughout the world.

Five Middle East oil states plus Venezuela joined in sessions at Baghdad to form the Organization of Petroleum Exporting Countries (OPEC). Membership is open to other oil-producing countries.

OPEC plans to demand that oil companies maintain stable prices and restore prices to levels existing before recent cuts. The members also are urged to help insure stable prices with limits on production.

Members will meet again in mid-November at Baghdad and will hold a plenary session in Caracas next January.

tral Bank; Dr. Mustafa Yasin, director general of the political department at the Ministry of Foreign Affairs; and Brig. Gen. Taha Shaikh Ahmad, director of planning at the Ministry of Defense.

Tariki led the Saudi Arabian delegation which also included Frank Hendryx, American lawyer retained as legal adviser to the petroleum directorate; and Faruq Husaini, petroleum economist.

Kuwait was represented by Ahmad Sayid Umar, director of the petroleum affairs department in the Ministry of Finance; Faisal Mazidi, of the petroleum affairs department who was recently appointed a government-sponsored director of Kuwait Oil Co.

Qatar was represented by Dr. Hasan Kamil, and Mohamed Salman, director of the petroleum department, attended on behalf of the Arab League.

In addition to Perez Alfonzo, the Venezuelan delegation included Dr. Antonio Araujo, Venezuelan ambassador to the United Arab Republic, Iraq, and Saudi Arabia.

Iran was represented by Fuad Rouhani, deputy director general of National Iranian Oil Co.

Alfonzo's aim . . . Venezuelan Perez Alfonzo has long dreamed of real and concrete cooperation between his country and the Arab oil producers. Both he and the Arabs insist that the companies which operate in both places are too interested in profits and not concerned enough about the welfare of their host countries.

Perez Alfonzo attended the Cairo oil congress last year at the invitation of the Arabs, but with no official standing. He was just an observer. He talked to receptive Arab groups, but nothing came of it. The Arabs paid lip service to his theory, but went home to push producing companies into ever-higher levels of oil production to increase revenue.

At home, the Venezuelan minister insisted publicly, and often, that he wasn't interested in seeing Venezuela's oil production rise very far above its present level. He has been subjected to criticism at home because of his oft-repeated statement that Venezuela is not interested in increasing its share of the oil market.

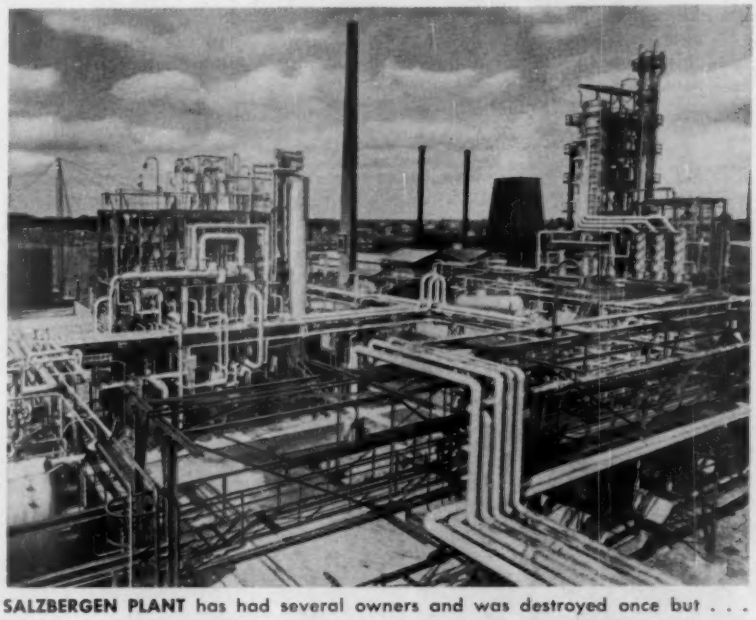
His announced goal is to keep Venezuela's present markets, which he says will normally increase at least 4% a year, and conserve his country's oil reserves.

This approach, he says, will assure the country an adequate oil income without rapidly depleting its oil resources and at the same time will assure firm, high oil prices and an accompanying high income to his country.

It is this part of his economic theory that has been embraced heartily by most Arabs. The Arab officials have historically urged producing companies to continue to increase production each year to insure an ever-higher level of oil income flowing into government treasuries.

The Arabs watched enviously 18 months ago when Venezuela suddenly by overnight decree increased its share of the oil income from a theoretical 50-50 profit split to something more like a 65-35 division. But, Venezuela was able to do this by changing its income tax laws. In the Arab oil world, the profit division is written into concession contracts and is much more difficult to revise.

Now that the Middle East has been hit where it hurts most—in the pocket—Arab oil officials may be more inclined to give more weight to the theory that some type of international regulation of oil output is necessary to insure stable prices.



SALZBERGEN PLANT has had several owners and was destroyed once but . . .

German Refinery Is Now 100 Years Old

THE OLDEST refinery in Germany, located at Salzbergen, began operations in 1860. The raw material for the primitive facilities was slate-oil.

Only 2 years later, the distillation units were processing American crude. The refinery, now owned by Wintershall A.G., was the first German importer of crude oil. Later crude was bought from Romania and then a switch was made to German crude following discoveries in Luneburg.

The plant was leveled during World War II, but was rebuilt in 1950-51. The plant has a throughput now of 2,300 bbl. daily. Capacity is to be doubled shortly when new units go on stream.

World Crude Prices Adjusted Higher

WORLD crude prices settled down to a common pattern with adjustments in the Middle East and Far East last week.

Esso Export Corp., the first company to cut Middle East prices and the deepest price cutter, restored as much as 4 cents a barrel to its price postings. This brought them into line with the smaller cuts posted by other major operators.

Shell, which originally met the Esso postings, already had adjusted its prices to meet the postings of Mobil, British Petroleum, and Kuwait Gulf.

Tidewater, meanwhile, joined the new price pattern by trimming its postings for Iranian crude by 4 to 8 cents a barrel.

The adjustments established this Middle East price pattern: Arabian crude (34°-34.9°) at Ras Tanura $1.80 per barrel; Iranian (34°-34.9°) at Bandar Mashur $1.78 and at Abadan $1.73; Iraq (35°-35.9°) at Fao $1.72; Kuwait (31°-31.9°) at Mina-al-Ahmadi $1.59; and Qatar (41°-41.9°) at Umm Said $1.95.

Crude Worries Hit Japanese

. . . marketers as the effect of Middle East cuts and new Neutral Zone oil begins to move to the east.

A FLIRTATION with marketing by the Japanese company with new crude production in the Persian Gulf, and a threat by utilities to switch to crude oil are causing headaches among Japan's established refiners and marketers.

Arabian Oil Co. had no problem finding takers for 80% of the 2.5 million barrels of Khafji crude it plans to bring into Japan from the Neutral Zone the first 3 months of 1961. This amounts to 28,000 bbl. daily. Total demand is rising fast above the 447,000-bbl.-daily level of last year.

But companies are concerned about the remaining 20% that Arabian Oil plans to dispose of by itself. While this will amount to less than 6,000 bbl. daily, companies are worried about the effects of this much oil coming into Japan's highly competitive market without established outlets.

Utilities power play . . . Japan's electric utilities are seriously considering a switch from fuel oil to direct crude-oil firing as a result of attractive crude prices.

This could affect a big chunk of the country's total market. Demand for fuel oil for power generation the current fiscal year is expected to total 25 million barrels, or 68,500 bbl. daily. This would be 2½ times last year's demand.

Power companies are now paying $3.50 to $3.55 per barrel as the delivered price for fuel oil. In contrast, the current laid-down price in Yokohama of 22°-gravity crude from Duri field, Sumatra, is $2.05 per barrel. Saudi Arabian 34°-gravity oil is brought in at a CIF price of about $2.64.

One power company, Tokyo Denryoku K.K., has carried out a successful 10-day crude firing test at its Tsurumi generating plant. It burned Duri crude as a typical low-sulfur oil, and Arabian crude as a representative high-sulfur oil. No serious difficulties were reported during the trial.

The utilities' interest in crude firing is further heightened by their 28% ownership in Arabian Oil. They already are applying to the government for special exchange allocations to import fuel and crude oils.

A price for Khafji crude has not yet been posted. But this action is expected soon.

Nine Concessions Granted in French Sahara

ROYAL DUTCH-SHELL has increased its acreage interests in the French Sahara with the award of a 4,525-sq. mile concession southeast of Hassi Messaoud oil field to Cie. des Petroles d'Algerie (CPA).

Shell has 65% interest in CPA, which must spend $6.5 million in exploration in the Lejamate permit in 5 years. An application on the block has been pending for 2 years. The center of the area lies about 100 miles southeast of Hassi Messaoud.

British Petroleum, through its half interest in Soc. des Petroles de Valence, also added to its Saharan rights with the grant of the 309-sq. mile Hassi Izi permit to Petroles de Valence. The company must spend at least $253,000 in 3 years.

The awards were among nine made by the French Government to individual firms or groups that included an Italian group, two German firms and one Canadian-based company.

Three Italian firms, including affiliates of Fiat, Montecatini, and SNIA Viscosa are partners with Prepa on the 1,506-sq. mile Hassi Allai-Erg Sedra permit. The agreement calls for a $2 million program in the first 5 years.

Germany's Gewerkschaft Elwerath is teamed up with Eurafrep and Petropar in the 1,197-sq. mile Hassi Nechou permit, where they will spend $1 million in 5 years. Wintershall Aktiegesellschaft is a partner with Francarep and Petropar on the 772-sq. mile Hassi Mestour permit, where a $1 million investment in 5 years is required.

Frandel, an affiliate of Canadian Delhi Petroleum, is a partner with Petropar and Francarep on the 1,583-sq. mile Rhourde Hamra permit. The minimum 5-year investment is $2.3 million.

SN Repal won the 1,699-sq. mile Mebrouk permit, where it will spend $2.2 million the first 5 years. SNPA acquired the 1,467-sq. mile Demrhat el Acha permit, where the minimum investment will be $1.9 million. Safrep was awarded the 579-sq. mile Rhourde el Baguel permit, where the minimum will be $833,000.

Caltex Surrenders French Properties

STOCKHOLDERS of Caltex SAF and Outremer de Navigation Petroliere SAF have approved the merger of Caltex French properties with a newly organized, French-controlled company.

Caltex facilities, including the 25,600-bbl. Gironde refinery and a marketing organization, will be turned over to Union Industrielle des Petroles (UNIP) in exchange for 40% stock interest. Tankers belonging to Outremer de Navigation, an affiliated shipping company, also are part of the package.

The move gives the government control over a little less than 4% of the domestic market. But there are some fears that the acquisition of the Caltex properties is only the start of a move by the government into behind-the-scenes control of marketing.

Marketing will be carried on under the Caltex trademark for the time being, but Caltex SAF and Outremer will go out of existence as operating companies. Division of the 40% interest in UNIP between the two firms will be decided later.

The remaining 60% interest in UNIP will be held by Union Generale des Petroles (UGP) owned by a group of French companies, partly controlled by the French Government's Bureau of Recherches de Petrole (BRP).

The UGP owners include RAP, a government-owned holding company, with one-third interest; and SN REPAL, half-owner of Hassi Messaoud oil field, with another third. The remaining third is held by Groupement des Exploitants Petroliers, which in turn is owned jointly by SPAEFE, SNPA, CEP and PREPA.

Some government quarters want UGP to absorb other independent marketers. The company was formed last spring after the government shuffled its original plans (OGJ, Apr. 25, p. 125).

Methods and equipment have changed through the years, but Houston Contracting has always been known for its quality construction, efficient handling and on-time completions. When you're planning your next pipe line project, talk to the men of Houston.
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HUDSON Combin-aire

LOW TEMPERATURE COOLING USING COMBINATION OF MINIMUM WATER AND MAXIMUM AIR

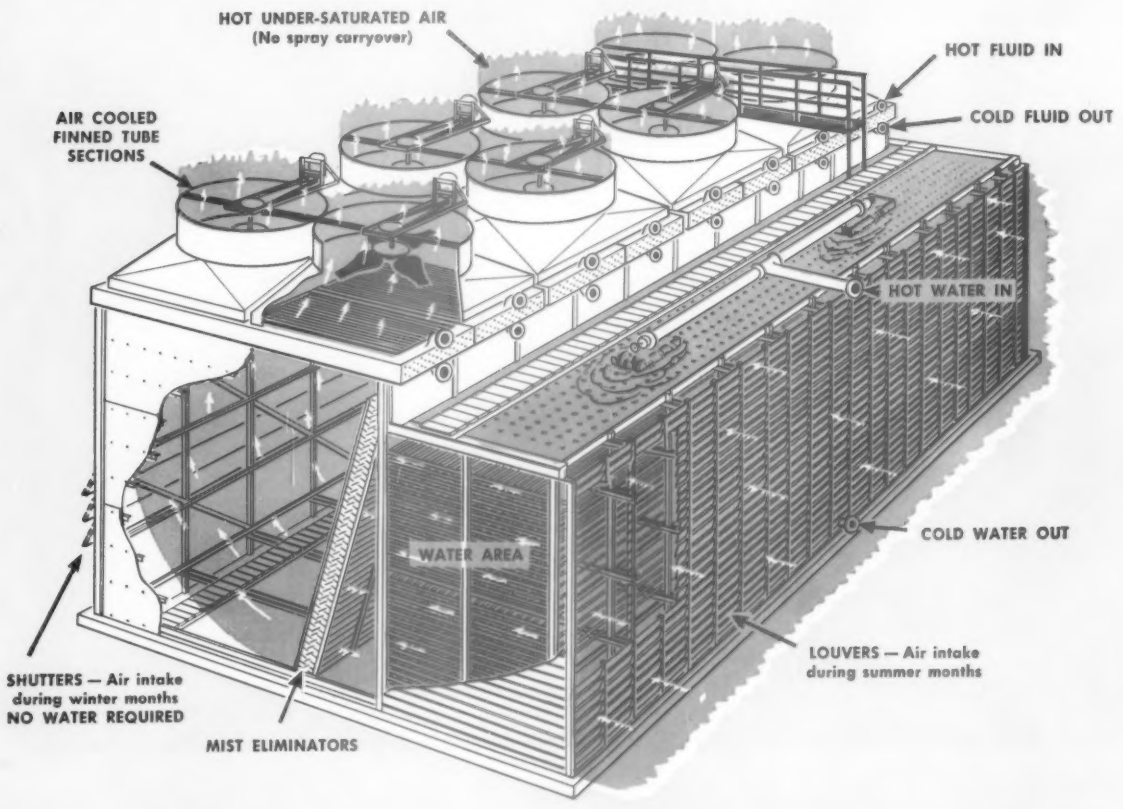
In recent years Hudson Solo-aire cooling in which only air is used as a cooling medium has been installed by the world's largest refineries. In recent cases of three separate 40,000 barrel complete refineries in locations where unlimited water is accessible Hudson Solo-aires are used for *all* process cooling.

So that air could be used for cooling those process streams requiring lower terminal temperatures than obtainable with ambient summer air temperatures, Hudson developed and in 1949 installed the first Combin-aire cooling unit. Since that time Combin-aires have proven their worth in installations for over 80 services in major refineries, chemical plants and gas processing plants in the United States, the Middle East, Europe, Mexico and South America.

In Combin-aire cooling, high temperature ambient air is first pre-cooled by direct contact with water, the cooled air then becoming the low temperature cooling medium for fin-tube elements. Cooling of air, and subsequent use of the cooled air for fin-tube cooling of process streams, are effected in one integrated structure — the Combin-aire.

Cooling with Combin-aire to overcome the occasional limitation of high ambient temperatures has the following advantages:

- **Absolute minimum water consumption consistent with attainment of low terminal process stream temperatures.**
- **Water circulation may be made automatically responsive to air temperatures with no water circulated except at high ambient temperature.**
- **No water treatment necessary. Salt water or brackish water may be used.**
- **No spray carryover or condensation. After passing across the fin-tube elements the heated air leaving the Combin-aire at elevated temperature is undersaturated with water vapor and cannot precipitate condensate or carry water spray.**
- **Minimum piping. Combin-aire may be installed immediately adjacent to other process equipment.**
- **Clean air to fin-tube units. During the hot season air is washed, removing dust, sand and insects.**



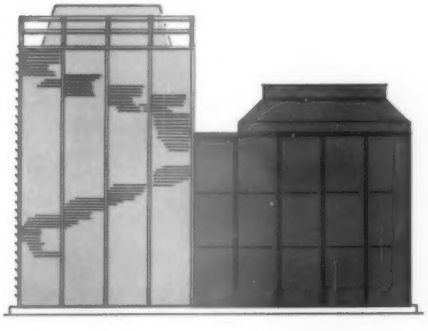
When Combin-aires are installed as adjuncts to cooling systems using existing shell and tube or other water cooled equipment the cooled water from the bottom of the Combin-aire may be used in such equipment. The Combin-aire then takes on the additional function of a water cooling tower with, however, the advantages over conventional cooling towers of dual use of both air and water and elimination of water spray carryover and condensate precipitation.

In over 80 services and under a wide range of atmospheric operating conditions Combin-aire units have amply fulfilled performance and mechanical specifications. Before proceeding with a new process unit or revamping or adding to present cooling systems let Hudson give objective assistance in determining the most economic balance in the use of air cooling, Combin-aire cooling and water cooling.

CONVERTING COOLING TOWERS INTO COMBIN-AIRE UNITS

Presently installed cooling towers may be used as the basis for Combin-aire cooling by installing structure with fin-tube elements and fans immediately adjacent to the cooling tower with air for the fin-tube elements being drawn across the water near the bottom of the cooling tower, thus increasing the capacity of the cooling tower, and cooling the air for use in the fin-tube elements.

EXISTING COOLING TOWER **COMBIN-AIRE ADDITION**



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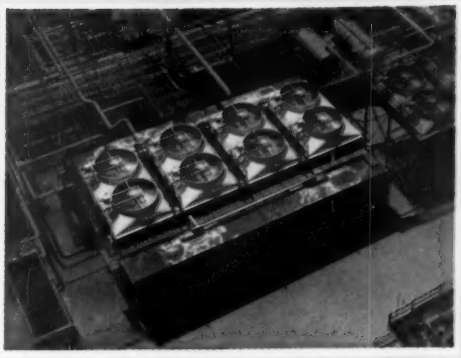

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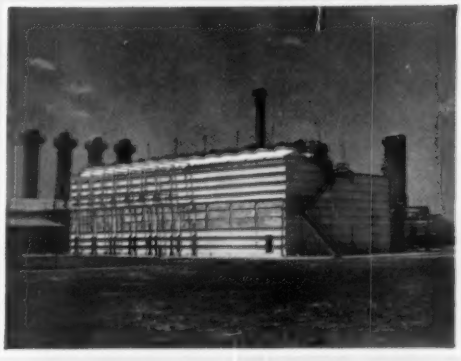

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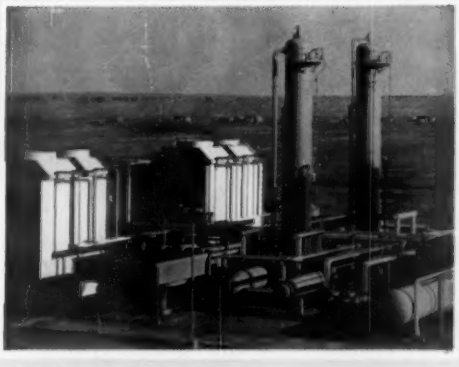

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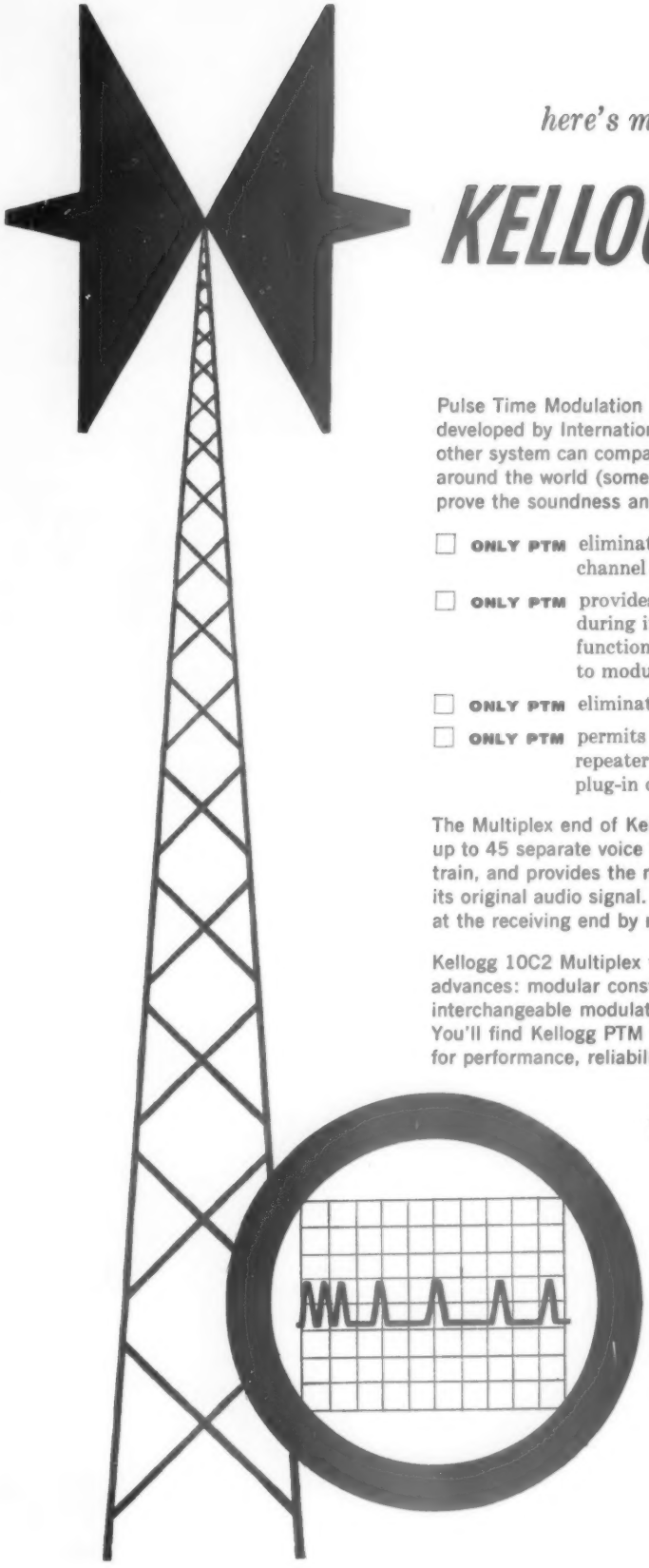

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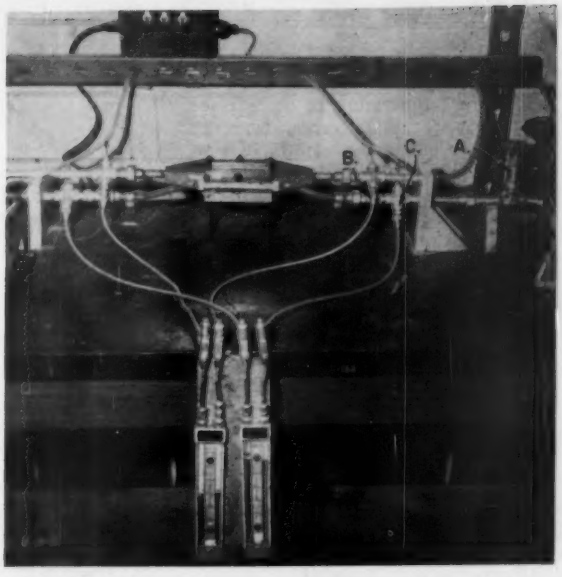
BY R. J. COLE AND F. W. JESSEN
Department of Engineering
University of Texas

Laboratory tests show how temperature gradient and surface wettability affect

Paraffin deposition



DEPOSITION CELL with connecting lines is shown here as used in the laboratory. B and C are manometer connections so that pressure drops across the cell can be measured. Valve A is used to control the flow of chilled water through the cell. Fig. 1.

This study showed that:

1. The temperature drop between the cloud point of a solution and the confining surface has an important effect upon the amount of paraffin deposited. Higher initial rates of deposition occur with increased temperature differential. However, over longer periods of time there is a decrease in accumulation rate because of the marked influence of the change in over-all heat conductivity caused by the deposited paraffin.

2. The wetting characteristics of the surface have a significant influence on the amount of paraffin deposited. By increasing the contact angle of water on the surface from 9° to 95°, the amount of paraffin accumulated for a given temperature differential was decreased 65%.

3. With surfaces having high free surface energy, the amount of paraffin deposited is reduced by addition of water.

LABORATORY investigation shows how temperature difference across a pipe wall can control the deposition of paraffin in an oil well. Silicone coatings can also influence deposition rate.

The problem of paraffin accumulation in tubular goods has always plagued the oil industry. It is not restricted to any specific geographical area nor particular type of crude petroleum.[1] Previous studies conducted by Howell and Jessen[2] reported the effects of rate of flow on deposition of paraffin.

The purpose of this article is to discuss the effect of temperature gradient at the interface between the pipe wall and the crude oil and the effect of wettability characteristics of pipe wall upon paraffin accumulation.

Temperature Gradient Tests

In this investigation, paraffin deposition occurred as a solution of paraffin in kerosine was passed over a copper plate in an arrangement similar to a heat exchanger. The plate was kept cool by passing chilled water on its other side. Details of the laboratory apparatus are shown in Figs. 1 and 2.

The solution contained 8.09% of 145° F.-melting-point refined paraffin with a 91° F. cloud point and was used throughout the investigation. It was maintained at a temperature of 100° to 102° F. so that the paraffin would remain in solution.

The flow rate of the kerosine solution through the deposition cell was held at a constant rate of 0.227 g.p.m. in all runs. The runs were made for a 2-hour period, and the kerosine solution was circulated through a bypass for 15 minutes before each run to insure that the solution was homogeneous.

In making a run, the flow rate of the water was adjusted until the desired rate of heat transfer through the deposition plate was achieved. The influx and efflux temperatures of the water and the kerosine solution were measured at least five times during each run. Surface temperature of the deposition plate was also measured at these times.

Upon completion of a run, the deposition cell was quickly disconnected from the paraffin flow line and all excess kerosine solution drained from the cell. The deposited paraffin was then solidified by cooling to approximately 40° F. by flowing the cooling water through the lower portion of the cell. The cell was dismantled, and the copper plate with its attached paraffin deposit carefully removed. By weighing the copper plate and the paraffin deposit, the amount of par-

This article was adapted from a thesis submitted to the department of petroleum engineering, The University of Texas, as a requirement for an M.S. degree.

affin accumulated during the run was determined.

In studying the effect of temperature gradient, runs were made in which the temperature of the surface of the copper plate varied from 2° to 52° F. below the cloud point of the kerosine-paraffin solution.

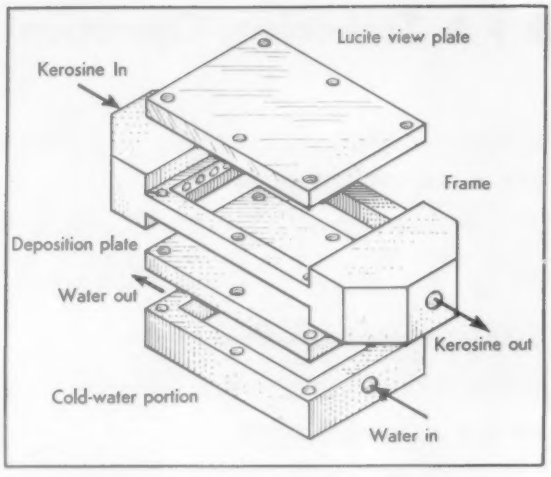
The initial rates of deposition for several different plate temperatures were measured. This was done by measuring the time required to deposit a perceptible film of paraffin at a given plate temperature. The amount of paraffin deposited was determined and the initial rate of paraffin deposition calculated in grams per minute.

Wettability Tests

The wettability characteristics of the copper plate were altered through the use of Dow Corning 200 Fluid, Dow Corning "22," and Dow Corning 840 Resin. These were applied to the copper plate by dipping after the plate had been thoroughly degreased. A smaller copper plate used in measuring the contact angle was treated simultaneously with the larger plate so the two surfaces would be identical. After dipping, the plates were cured at the proper temperature until the silicone film was hardened. The contact angles of water and kerosine on the treated surfaces were measured.

To determine the effect on deposition of a surface exhibiting a low contact angle with water, a steel plate was used.

The investigation was carried out in the same manner as for the study of temperature gradient effect. For the last two series of tests, 5% by weight of water was added to the kerosine-paraffin solution. These two series were run using a silicone-coated copper plate and the steel plate.



EXPLODED view of the deposition cell showing construction details. Fig. 2.

Discussion of Results

The flow rate chosen for these tests, 0.227 g.p.m., resulted in a Reynolds number of 40.0 and indicated laminar flow conditions.

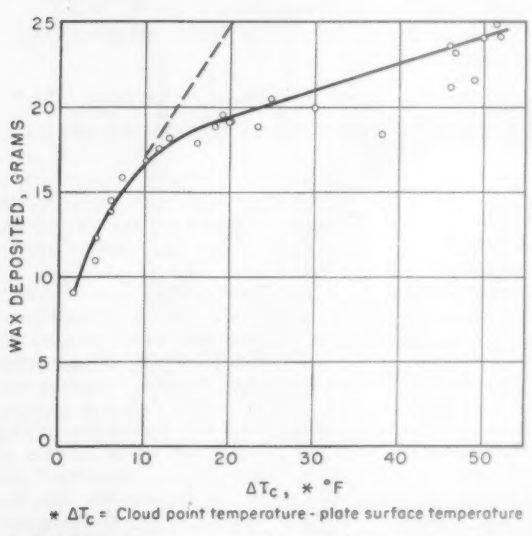
Inlet temperature of the kerosine-paraffin solution was generally 10° F. above the cloud point. The temperature differential ΔT between the cloud point of the solution and the face of the plate was considered most important in controlling the accumulation.

Temperature drop across the plate was found to be negligible.

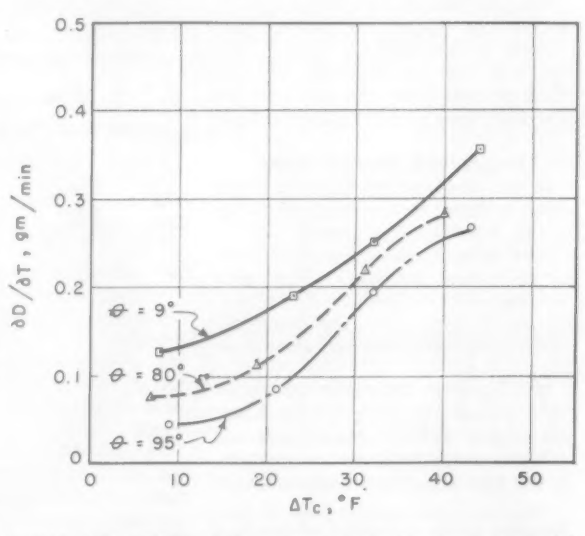
Paraffin formed a film of uniform thickness throughout the length and width of the plate. The thickness of the film varied from 1/64 in. to ⅜ in. After cooling to about 40° F., the deposit still contained 8% kerosine by volume necessitating a correction in computing the weight of paraffin deposited. The paraffin was in crystalline form, but enough kerosine was retained to make its consistency that of a heavy paste.

Effect of temperature. The temperature of the plate surface was varied from 89° F. to 39° F. during the test runs, Table 1. The flowing temperature of the kerosine-paraffin solution entering and leaving the cell varied only by 2° to 3° F. There was little heat loss from the cell to the surroundings by radiation, so essentially all cooling of the kerosine solution occurred at the face of the deposition plate. The small change in temperature of the kerosine as it flowed through the cell indicated that only a thin film of the kerosine adjacent to the plate was cooled.

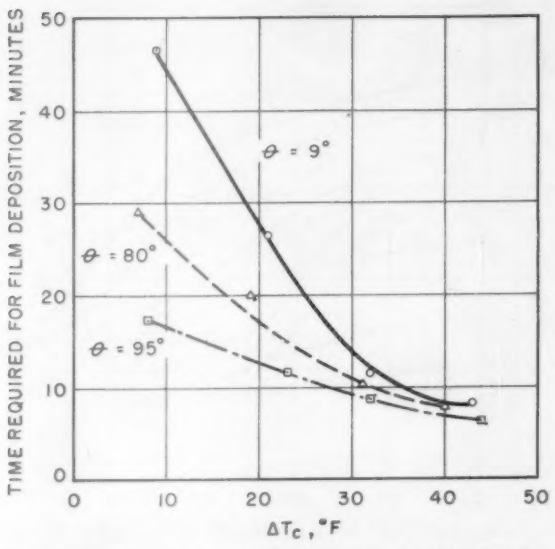
The observed variation of paraffin



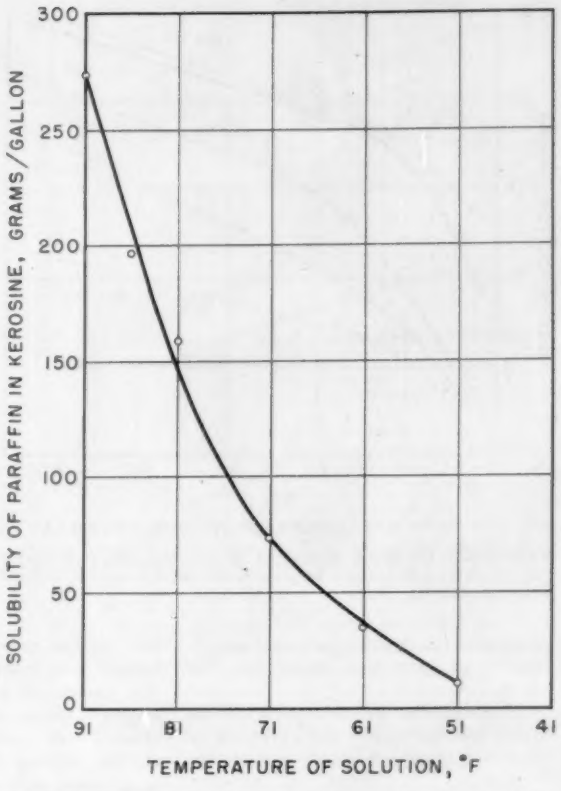
INFLUENCE of temperature differential on amount of wax deposited in 2-hour test. Fig. 3.



INITIAL DEPOSITION RATE is affected by the temperature differential and contact angle. Fig. 4.



TIME REQUIRED for the deposition of a 1/64-in. paraffin film at different temperatures and contact angles. Fig. 5.



SOLUBILITY CURVE for 145° F. melting point wax in kerosene. Fig. 6.

deposition with temperature differential is shown in Fig. 3. Considering the change in deposition with ΔT_c at constant time $(\delta D/\delta \Delta T_c)_t$, the variation in the amount of paraffin deposited over a finite time is clearly demonstrated.

Fig. 4 presents data on the initial rate of paraffin deposition with temperature differential and contact angle. As the temperature gradient increased, the initial rate of paraffin deposition increased also.

Fig. 5. shows the variation with temperature differential and the time required to deposit a paraffin film 1/64 in. thick. This is the average thickness of the first perceptible film formed on the copper plate. The time calculated for the film formation is based on values obtained for the initial rates of deposition shown in Table 2.

For a test interval of 2 hours, the paraffin deposition at the lower temperature differentials was low. This was due primarily to the low initial deposition rate. The deposited paraffin at these low temperature differentials formed only a thin film of paraffin on the plate which had little effect on the heat conduction from the solution to the plate. However, as the temperature differential became greater, the initial rate of paraffin deposition increased, and a fairly thick film of paraffin was deposited on the plate in a short period of time.

The thermal conductivity of paraffin[3] is

$$0.00056 \frac{\text{cal/cm}}{\text{sec/°C/cm}^2}$$

or about 0.05% that of the copper plate. This low thermal conductivity of paraffin results in a great change in over-all thermal conductance as the paraffin film is formed. For example, to secure the same rate of heat conduction occasioned by a 10° F. temperature differential across the bare plate alone would require an over-all theoretical temperature differential of 104° F. with a 1/16-in. film of paraffin on the plate.

However, in this investigation, the paraffin deposited on the plate was cooled quickly to the temperature of the plate, and the effective thickness of the paraffin for insulation purposes thereby greatly reduced. Thus, the temperature differential across the copper plate with attached paraffin film was diminished substantially. On the other hand, the temperature of the paraffin surface was increased greatly as the film thickened and the temperature differential at the interface between the solution and paraffin film decreased with the thickness of the paraffin film.

This action contributed to the change in the total amount of paraffin deposited over a finite time period, and hence the inflection point in the curve of Fig. 3.

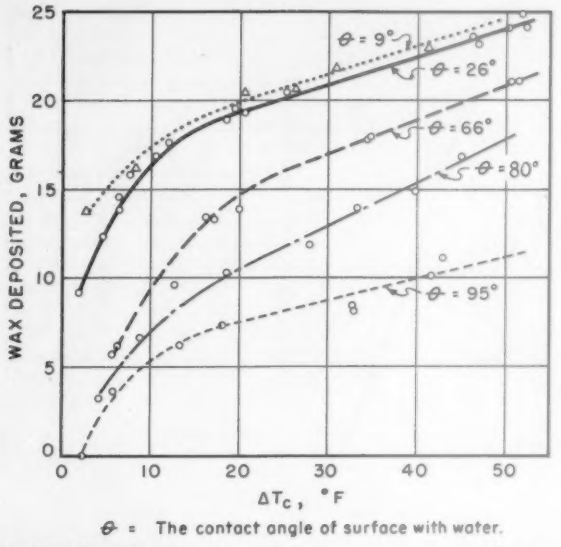
At first this may appear to be contrary to expectation; however, the fact that the variation in heat conductivity of paraffin and copper is so pronounced accounts for the inflection in the temperature - deposition curve as the paraffin film thickens. Computation of the thickness of the deposit at the inflection point shows a value of 0.1182 in. of paraffin.

Also contributing to this change in deposition is the variation in solubility with temperature, Fig. 6. The rate of change of paraffin solubility with temperature is much greater just below the cloud point than it is for lower temperatures. Hence, the change in rate of paraffin deposition with temperature is the result of (1) thermal insulation by the deposited film and (2) variation of the amount of paraffin available for deposition per degree temperature differential.

The paraffin deposited initially results primarily because of the temperature drop at the plate surface while thereafter the over-all heat conductivity becomes the controlling factor.

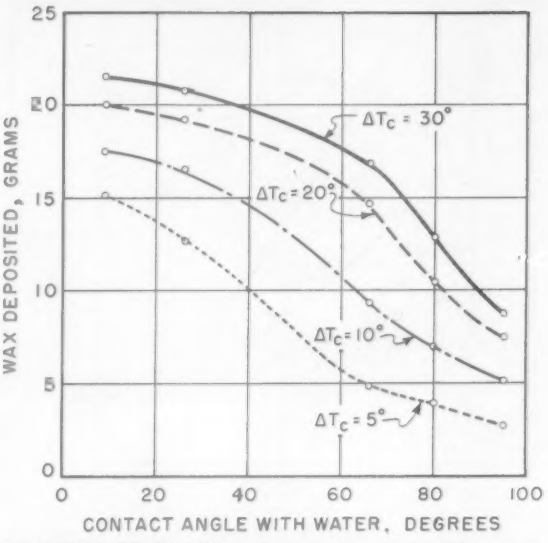
Effect of Surface Wettability

Wettability characteristics of the copper-plate surface were varied through the use of Silicone products manufactured by Dow Corning Corporation. Thin films of the Silicone were formed on the surface of the



θ = The contact angle of surface with water.

VARIATION OF WAX deposited with temperature differential for different contact angles. These tests were for a fixed time period. Fig. 7.



VARIATION OF AMOUNT of wax deposited with contact angle is shown for different temperature differentials. These tests were for a fixed time period. Fig. 8.

plate, and the resulting contact angles relative to water were measured, Table 3.

Although the kerosine-paraffin solution wet all plates, the variation in contact angle with water shows the free surface energy of the plates decreased with increasing contact angle. The amount of paraffin deposited for a given temperature differential decreased with increasing contact angle of the surface with water, Fig. 7.

Change in temperature differential resulted in a deposition pattern similar to that observed on the untreated copper plate. Change in paraffin deposition with temperature differential again was linear to ΔT_c values of 14° F. Above ΔT_c values of 14° F. the deposition pattern was found to be essentially the same for all the surfaces examined.

The variation of paraffin deposition with contact angle is shown in Fig. 8. Note the similarity in the shape of the curves for the four temperature differentials shown. Deposition was found generally to vary much more rapidly with surfaces which had

TABLE 1—VARIATION OF PARAFFIN DEPOSITION WITH TEMPERATURE DROP

Plate—Copper
Contact Angle of Water on Surface—25.9°

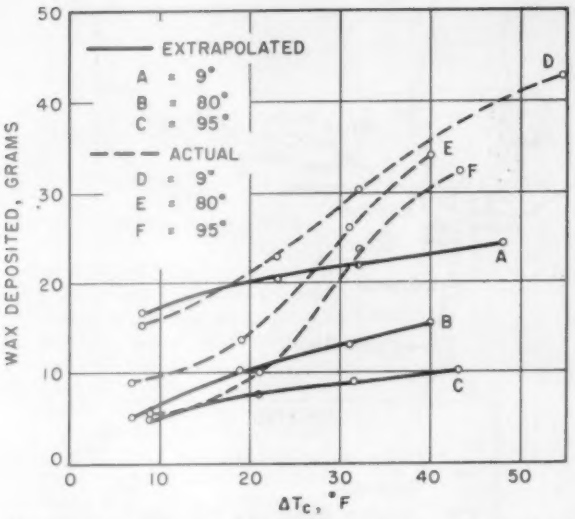
Mean temperature of kerosine in cell °F.	Plate temperature °F.	ΔT_c* °F.	Paraffin deposited Grams
99.6	89.3	1.7	9.11
99.2	86.7	4.3	12.28
99.6	87.6	3.4	10.77
99.8	84.8	6.2	13.76
99.6	84.8	6.2	14.55
99.9	83.7	7.3	15.78
99.5	80.7	10.3	16.69
100.4	79.4	11.6	17.65
100.6	78.1	12.9	18.24
100.1	73.7	17.3	18.78
100.2	74.7	16.3	17.93
100.4	71.6	19.4	19.56
99.6	71.0	20.0	18.89
99.4	71.0	20.0	19.24
95.6	67.6	23.4	18.91
99.6	63.6	27.4	20.49
100.3	60.8	30.2	19.79
99.4	52.9	38.1	18.44
99.5	48.0	43.0	21.13
99.2	45.0	46.0	23.63
100.3	44.4	46.6	23.22
100.3	42.0	49.0	21.54
99.9	41.0	50.0	24.16
99.6	39.0	52.0	24.24

ΔT_c = Cloud point of kerosine solution — Temperature of plate surface.

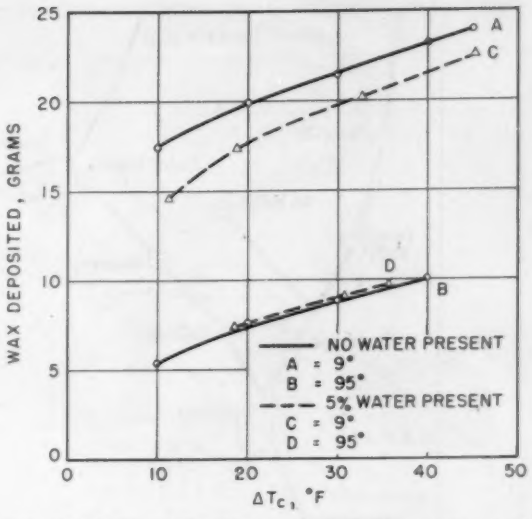
TABLE 2—VARIATION OF INITIAL PARAFFIN DEPOSITION RATE WITH TEMPERATURE AND CONTACT ANGLE

Contact angle of water on surface, °	ΔT_c °F.	Paraffin* deposited Grams	Deposition time Minutes	$\frac{\partial D}{\partial t}$ Grams / minutes
95	9	2.178	47.0	0.046
	21	2.232	26.5	0.084
	32	2.258	11.5	0.196
	43	2.198	8.2	0.267
80	7	2.198	29.0	0.076
	19	2.186	19.8	0.111
	31	2.232	10.2	0.219
	40	2.214	7.8	0.284
9	8	2.186	17.2	0.127
	23	2.202	11.6	0.190
	32	2.218	8.8	0.252
	44	2.207	6.2	0.356

*Paraffin deposited on an area of 10.8 sq. in. giving a film thickness of approximately 1/64 in.



ACTUAL AMOUNT OF PARAFFIN deposited is compared with amount that would have been deposited if initial deposition rate were extrapolated for a 2-hour period. Fig. 9.



THE ADDITION OF WATER to the kerosine solution had more affect on the system with a low contact angle than when the contact angle was high. Fig. 10.

high and intermediate contact angles (above 50°) than those having low contact angles relative to water. From these data it is indicated that temperature differential and the free surface energy of the plate surface act independently in determining the amount of paraffin deposited.

A study was made of the effect of plate temperature and wettability characteristics on the initial rate of paraffin deposition. The deposition measured in this instance occurred essentially on the bare surface of the plate since the test was terminated immediately upon observation of the first perceptible film of paraffin.

A comparison of the deposition obtained and the paraffin which would have been deposited had the initial rate of deposition continued for the 2-hour test period is shown in Fig. 9. Actual deposition and the extrapolated deposition for each of the three plate surfaces tested agree up to an approximate ΔT_c value of 17° F. However, beyond this point the two values begin to show increasing variation, the observed deposition of paraffin being much less than the extrapolated value.

Water was added to the kerosine-paraffin solution. Two different deposition surfaces were used, the first with a low contact angle, and the second with a high contact angle relative to water. The results of these tests are shown in Fig. 10. Paraffin deposition on the more water-wet surface was materially reduced by the presence of water while the amount deposited on the surface with a high contact angle was unaffected.

The wettability characteristics of the surface have a great effect upon the amount of paraffin deposited for a given temperature differential. As the free surface energy of the surface decreases, paraffin deposition from a water-free solution decreases. The presence of water causes a decrease in the paraffin deposition on surfaces with high free surface energy.

It works this way. As paraffin is deposited on a surface, it is held in place by adsorption forces. These adsorption forces are dependent upon the free surface energy possessed by both the paraffin and the surface. As the free surface energy of the plate is reduced, a resultant decrease in the adsorption force holding the paraffin to the plate surface takes place. This causes a decrease in the amount of paraffin which can be retained on the plate surface for the flow conditions present.

The reduction in paraffin deposition on the high free-surface-energy plate caused by the presence of water may be explained in a similar manner. The adsorption forces between the water and the high-energy surface are stronger than those between the paraffin and the surface. Water will then be preferentially adsorbed to the surface, preventing the retention of paraffin on the surface. If enough water is present to completely cover the surface, there should be little if any paraffin deposition because of the very small interfacial tension between paraffin and water.

TABLE 3—CONTACT ANGLES OF WATER AND KEROSINE ON PLATE SURFACES

Plate	Surface coating	Contact angle with water (deg.)	Spreading coefficient with water	Contact angle with kerosine
Steel	None	9.0	− 0.855	Spreads
Copper	None	26.0	− 7.039	Spreads
Copper	Dow Corning 200 Fluid	66.0	−41.269	Spreads
Copper	Dow Corning "22"	80.0	−57.477	Spreads
Copper	Dow Corning 840 Resin	95.0	−76.829	Spreads

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Howell, J. N. and Jessen, F. W. "Effect of Flow Rate on Paraffin Accumulation in Plastic, Steel, and Coated Pipe," Journal of Petroleum Technology, 1958 10 4 p. 80-84.

3. Beale, "Science of Petroleum," New York, 1938, 2, 1261.

DIRECT PIPELINE-TAKEOFF terminals will be built at St. Joseph, Mo., and Constantine and Girard, Mich. These will be similar to the direct terminal now in operation at Trenton, Mo. Terminal at Cedar Rapids, Iowa, will be similar, but will have tankage also. Fig. 1.

Pipeline to truck — in direct takeoff

. . . that's how Indiana Standard is moving, even at unattended stations. Here's the story of how it's done

BY DONALD A. KNOELKE

. . . staff engineer in the hydraulics and economics section, supply and transportation operations engineering department, Standard Oil Co. (Indiana). He is currently engaged in a program of extensive study of methods of automation, control, and improved operation of Standard's transportation facilities. Prior to joining Standard in April 1959, Knoelke spent 8 years with Service Pipe Line Co. in Tulsa as engineer and construction-party chief. He holds a BS in civil engineering from Marquette University.

TO JUSTIFY an expenditure for the construction of the unattended pipeline terminal at Trenton, Mo., savings had to be realized. An annual volume of approximately 400,000 bbl. yielded enough overland - transportation savings to justify building a minimum terminal facility such as the one at Trenton. Only limited operating staff was required to handle this volume, thus keeping the operating expense to a minimum. Once expenditure was justified and approved, design of the terminal was carried to completion. This article deals with the principles of design and operation of the Trenton (key-stop) facility and its recent variations.

Cost records indicate that the incremental cost of operating this small-volume terminal is about the same or less than the incremental cost of operation at Standard's larger-volume terminals. Stock losses that are normally attributed to vapor losses from storage tanks are eliminated completely at a terminal of the Trenton type.

Terminals of the types discussed will reduce distribution costs considerably in the future. The success of the Trenton facility is the forerunner of further advancement in this phase of the oil industry's operation. The factors that attributed to making this facility a success are twofold: (1) low cost of operation and minimum capital investment requirements, and (2) in the form of overland transportation savings.

It was first thought that by con-

Indiana Standard is pioneer in direct truck loading

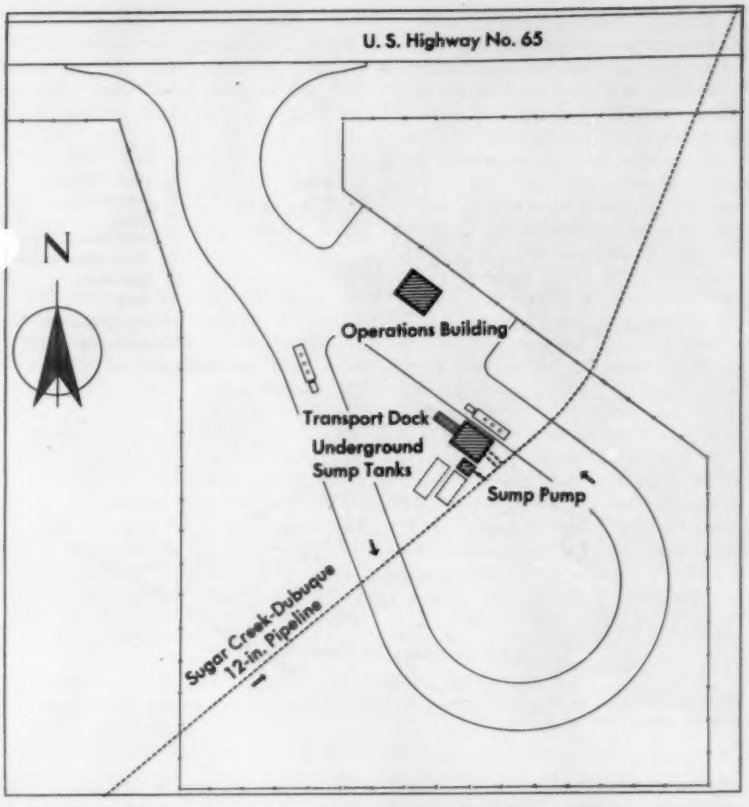
The Trenton, Mo., (key-stop) facility is an unattended station that permits truck loading directly from Sugar Creek-Dubuque Pipeline of Standard Oil Co. (Ind.). This facility went into limited operation in September 1958, loading gasolines only. In October 1958 the terminal went into both gasoline and oil service. Approximately 50 bulk plants are supplied by this terminal. The fact that Indiana Standard's pipelines handle its own products exclusively lends itself readily to the operation of unattended pipeline terminals without tankage.

To reduce terminal construction costs and to lower operating expenses has been a prime economic target in recent years. With this in mind, Indiana Standard has been attempting to design minimum terminals. A pioneer development along these lines was initiated at Colon, Mich., when an existing bulk plant was converted to an unattended pipeline terminal.

The Trenton type of operation will be extended to other locations in Standard's pipeline system where economic opportunities exist. At present, a terminal located in the vicinity of Cedar Rapids, Iowa, is under construction. The essential difference between that terminal and the one at Trenton is that minimum tankage will be provided at Cedar Rapids to insure constant supply of gasoline for delivery to service stations. Other Trenton-type terminals, in the vicinity of St. Joseph, Mo., and Constantine and Girard, Mich., are presently in the design stage.

Various types of pipeline takeoffs, serving Standard's service stations on the Indiana toll road and an existing terminal at Lafayette, Ind., are now in operation. Fig. 1 shows the general location of these terminals in relationship to Standard's existing pipeline system.

A brief account of Standard's key-stop direct loading appeared in The Oil and Gas Journal, May 16, 1960, p. 102.



PLOT PLAN of Trenton terminal shows relation of facilities to 12-in. main line from Sugar Creek refinery. Fig. 2.

structing direct-loading terminals on an operating pipeline, surge problems might be experienced during or immediately following the opening and closing of the takeoff valves. Tests conducted before construction of the Trenton facility indicated that this anticipated surge problem was not great enough to interfere with pipeline operations.

The surge problem has not yet developed as at first anticipated. If the Trenton facility were located closer to the station, we feel that surge problems might possibly arise.

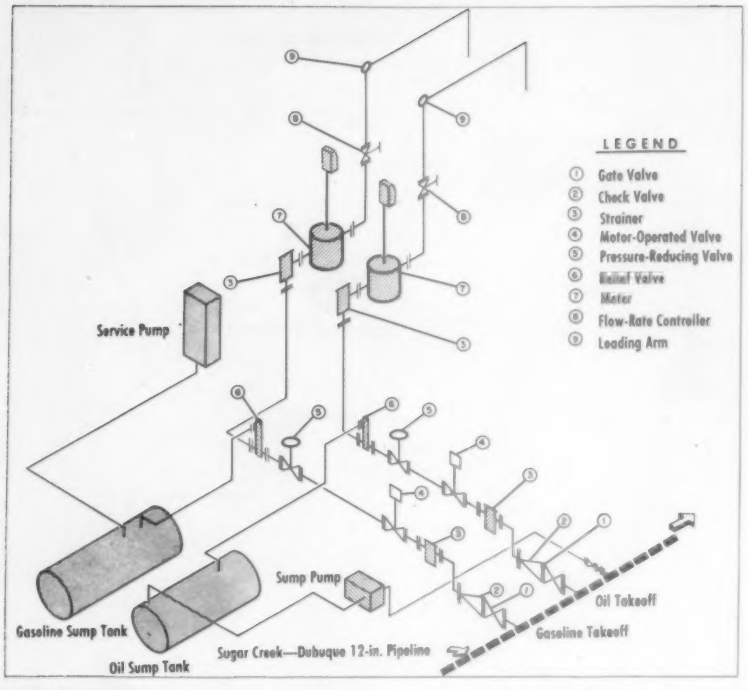
The only refinement now being considered is installation of a flow controller at the origin station on the Sugar Creek-Dubuque line. This flow controller would eliminate the possibility of overloading the constant-speed electric motors at Sugar Creek station during the delivery period at the Trenton terminal. Main reason for this overloading condition is that the pumping equipment is operating so close to its upper limits. To eliminate this overloading condition, personnel at the origin station now manually operate the valves. We believe that with installation of these flow controllers the problem will be minimized.

Before designing a facility such as Trenton, various decisions had to be made as to the method of operation. Here are some of them:

1. One or two takeoff connections.
2. Top or bottom truck loading.
3. Attended or driver loading.
4. Local or central remote control.

Trenton was selected as a terminal location primarily because of its main economic advantage in potential overland transportation savings. It is situated at the intersection of Highway 65 and Standard's Sugar Creek-Dubuque 12-in. main line. This plant is about 80 pipeline miles downstream of Standard's Sugar Creek pumping station. Standard's existing Ottumwa, Iowa, terminal is 92 miles downstream from the Trenton site.

Plant facility. Two 2-in. pipeline takeoffs are tapped into Standard's 12-in. main line, one for handling gasolines, and the other for oils. Each line is connected through a series of valves, controls, and piping to a meter located on a small one-spot truck dock. The meter and loading arms are essentially the same as those found in a conventional truck dock. Telephone, a control panel, and office space are housed in a small building,



PIPING DETAILS of Trenton terminal show features which permit delivery of full line of gasolines and oils. Fig. 3.

and a crushed-stone parking area is provided for trucks. The general plant layout is shown in Fig. 2.

Loading procedures. Since only the product that is passing through the Sugar Creek-Dubuque line at the Trenton terminal can be loaded into transport trucks at any given instant, loading operations must be coordinated with the pipeline schedule via the central dispatching office in Chicago. The supervisor at Trenton plans loading schedules in advance since pipeline tenders are available to him.

Staffing of terminal personnel. The Trenton operation is staffed with a supervisor and 10 drivers operating four transport trucks. This operation is regarded as a satellite activity of a larger terminal located at Ottumwa. The Ottumwa terminal processes all of the paper work originating at Trenton. The terminal superintendent at Ottumwa is in general supervision of the Trenton operation. The supervisor performs various maintenance duties besides being a stock distributor and scheduler of trucks.

The sequence of loading operation performed by the transport drivers is as follows:

1. When the driver wants to load a particular product, he calls the dispatcher at the central dispatching office in Chicago to start the takeoff sequence. The transport driver notifies the dispatcher that he intends to load a predetermined quantity of a particular product.

2. The driver then unlocks the key-operated control which in turn unlocks a relay setting up the circuit so the dispatcher can complete it.

3. If the specified product is passing the Trenton terminal, the pipeline dispatcher in Chicago approves the loading request and dials a code on the telephone circuit which closes a second relay connected to the motorized valve. This permits the truck driver to continue with his loading procedure.

4. The driver then sets the required volume for loading on the meter set-stop head. The delivery ticket is inserted into the printing meter, thus enabling the truck driver to proceed with the same loading operation as performed at a conventional Standard terminal.

5. After the loading operation is complete for fuel oils, the flash point of each load is tested by the truck driver before the transport leaves the terminal.

6. The truck driver then returns to the office and removes his product control key from the panel. This automatically trips all relays so that additional product cannot be loaded until the control panel is again keyed in and reset by the pipeline dispatcher in Chicago.

Emergency or abnormal operations:

1. If power fails during the loading operation, the solenoid valve will close, thereby shutting off flow from the main line.

2. Provisions are installed so that drivers can load manually in the event of a malfunction in the controls.

3. When flushing of the takeoff line is required, the driver will be so advised by the dispatcher on his initial telephone contact.

4. In the event of an emergency requiring a fast shutoff, the driver closes the set-stop loading handle. Movement of the loading handle towards the closed position actuates a microswitch deenergizing the motorized valves which then close.

The piping design of the Trenton facility is shown schematically in Fig. 3. The more important features of the design are as follows:

1. Two meters and loading arms are provided, one for loading gasolines and one for oils. The loading rate is 500 g.p.m.

2. Flushing of the line fill (house-brand) to permit loading of uncontaminated premium is made through the loading meter into the 4,000-gal. underground tank. Gasoline from this tank is metered out as fuel for the transports.

3. Flushing of the line fill (No. 1 fuel oil) to permit loading of uncontaminated No. 2 fuel oil is carried out by pumping through the loading meter to the sump tank. The sump tank is evacuated into the main line when the appropriate batch is passing the terminal.

4. A motorized takeoff valve was selected to give a controlled time of opening. Field tests indicated that at a loading rate of 500 g.p.m., the time of opening from the main line should be at least 15 seconds and preferably 25 seconds. If the valve is opened too quickly, the control valve cannot take over fast enough and the relief valve will pop. In addition, opening the valve too rapidly will cause some splashing in the truck compartment with consequent product loss.

The closeout time of the valve can be appreciably less than the opening time. Hydraulic tests indicate that a valve closing cycle of 6 to 8 seconds should be used. The loading operation is stopped by means of the solenoid-operated valve which closes in this period of time.

5. The control valve is set to reduce the line pressure to approximately 40 psi. A 2-in. self-contained diaphragm reducing valve is used for this purpose.

6. The relief valve is required as emergency equipment to relieve excessive pressures in the event that the reducing valve fails to operate correctly. The relieved product is directed

to the 20-bbl. underground tank which is equipped with the liquid-level device to shut down the system on high-product level.

Other Variations in Unattended Terminal Design

Lafayette terminal. The Lafayette terminal uses the semiattended feature of remote-controlled pipeline receipts. It is located on the Whiting-Indianapolis line and has four storage tanks, each provided with an individual meter and motorized meter isolating valve. One motorized valve isolates the pipeline from the terminal takeoff line.

An operator is required prior to the filling of any tank to determine the amount of tank fill required and to adjust the meter set-stop counters accordingly.

A telemetering installation is provided to transmit meter readings from the terminal to Standard's Whiting station by a leased telephone wire. Once set for remote operation, the particular tank can be filled by the station engineer at Whiting station.

Toll-road service stations. Presently, Standard operates pipeline-takeoff connections to two service stations located on the Indiana toll road. These connections are made to Standard's Whiting-River Rouge Pipeline; one near Michigan City, Ind., and one at South Bend, Ind. The South Bend takeoff is located immediately adjacent to the main line while the Michigan City takeoff is 4 miles south of the main line. A 3-in. lateral connects the service station at Michigan City. All takeoff volumes are received directly to service station tankage.

The method of operation at these service centers deviates slightly from the Trenton operation. The station attendant contacts the dispatcher at the central dispatching office in Chicago only to get permission to take off the desired gasoline product. Upon receiving this approval, the station attendant has complete control of the operation. He has to control all valves, flush the line of product when necessary, and meter the receiving product. The managers at the service-station centers are responsible for the complete operation of this takeoff facility.

Cedar Rapids terminal. This terminal is located on Standard's Sugar Creek-Dubuque line at MP 242, 70 miles downstream of Standard's Ottumwa terminal. This terminal consists of two 5,000-bbl. storage tanks for gasolines with a separate piping system installed for each tank. The oil loading will be done by a direct pipeline takeoff in the same manner as the Trenton facility. The truck dock will be a one-spot dock with three loading arms and space for a fourth. One arm for each grade of gasoline and one arm for the oil takeoff will be provided. The basic design is essentially the same as the Trenton terminal and permits only the dispatcher to initiate withdrawals of products from the pipeline. A brief description of the oil and gasoline systems is as follows:

Oil system. This is the same as Trenton with one exception. To make a withdrawal, the operator inserts his key in the switchboard and then calls the dispatcher who will complete the circuit by telephone. This enables him to load the truck. The motorized valve will operate by the microswitch that is actuated by the opening and closing of the set-stop counter. The loading rate will be 500 g.p.m. When loading is completed, the operator will remove his key and break the circuit. A 2,000-gal. oil-drain tank will be provided to flush the system between products.

Gasoline system. Both gasoline products will have separate takeoffs and separate lines to their individual tanks. The takeoffs will be similar in many respects to the oil takeoffs. The main difference will be in control.

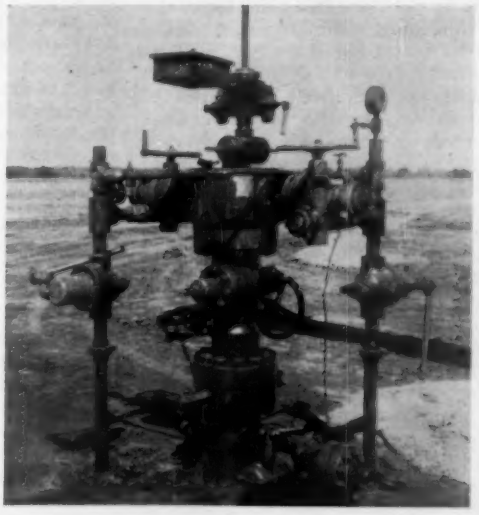
With the manual valve open, the operator sets the required volume on the set-stop head of the receiving meter. The dispatcher now has control of opening into the tank. The dispatcher will dial the motorized valve open. The flow control valve will set a rate of 500 bbl. per hour into the tank.

The high-level switch on the tank will close the motorized valve on high liquid level. The dispatcher can dial the valve open again when the product level in the tank has been lowered. This operation is based on the premise that a large batch is passing the takeoff point and loading operations lower the liquid level to the point where more product can be taken into the tank. In case of power failure, the motorized valve fails safe in a closed position and will have to be dialed open again by the dispatcher.

Each tank will have a pump located near the tank and individual discharge lines to the truck dock. This dock will have meters, loading arms, and other associated equipment that are normally in dock design, with the exception of air eliminators. The gasoline loading will be controlled by a key-operated switch located in the office building. Product will be accounted for in the gasoline takeoff by installing a receiving meter with a set-stop head in the takeoff assembly.

LEASE TIP

High-pressure gas used to clean flow-line paraffin

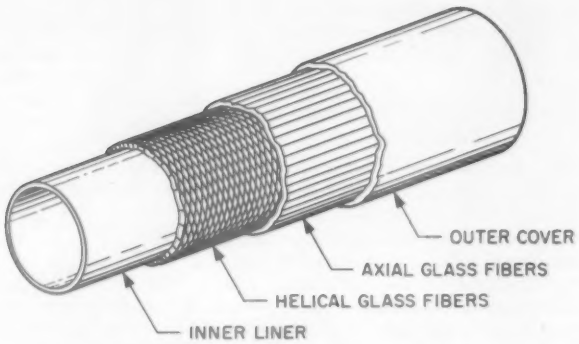


WHERE PARAFFIN is a problem in pumping wells, and the dual side has high-pressure gas, the gas can be used to follow up a pig to clean out the flow line.

A connection is made from the high-pressure side to the top of a tee on the tubing side. After the pig is inserted in the bull plug opening, the gas valve is opened and the line is quickly and cleanly purged.

The battle against corrosion may lead to increased use of

glass-reinforced plastic pipe



COMPOSITION of glass-reinforced plastic pipe. Fig. 1.

These characteristics favor glass-reinforced plastic pipe: corrosion-resistant, high strength, light weight, improved flow characteristics, resistance to paraffin deposition, low thermal and electrical conductivity, noncontamination of product, and ease and economy of installation.

BY ROBERT M. LEVY
Esso Research and Engineering Co.,
Linden, N. J.

THE NEED for a corrosion-resistant piping material has led to the use of many alloys and nonmetals. One of the more recent and most promising of these materials is plastics—and more particularly, glass-reinforced thermosetting plastics.

Unlike most other piping materials, glass-reinforced plastic presents a very complicated physical behavior pattern under the combined actions of stress, environment, and time. In addition, this pattern is affected greatly, not only by the individual behavior of the reinforcement material and the plastic, but by interaction of the two. Because the technology of the glass-reinforced plastic is comparatively new, much remains to be learned of the mechanisms involved in this combined behavior.

In the petroleum industry, the principal use of glass-reinforced plastic pipe is believed to be in crude-gathering lines, salt-water-disposal lines, and water-flooding operations. As downhole tubing, it has been used in salt-water-disposal wells, pumping wells, and combination injection and disposal wells.

Limited applications can be found in refinery offsites and aboard tankers.

Thermosetting plastics, as the name implies, set or harden under heat to the final form which cannot be changed upon reheating. Presently there are three types being used in pipe manufacture: polyester, epoxy, and phenolic.

Since the plastic resins used are generally brittle in nature and low in tensile strength, reinforcing is required. Although cotton, sisal, paper, asbestos, and other organic fibers have been used, glass fibers are the most common reinforcing material.

Paper presented at ASME petroleum-mechanical conference, New Orleans, Sept. 19-21, 1960.

Actually, the resin contributes very little to the strength of the structure. Its main function is that of stress transfer, protection of the reinforcement from external physical and chemical attack and, in the case of glass, protection from the abrasion of the glass on itself. In addition, the resin serves to stabilize reinforcement filaments when the structure is put in compression.

Since most thermoset pipe being produced or in development is of glass-reinforced epoxy resin, this discussion will specifically refer to this type, although much is applicable to polyester, phenolic, and other thermosetting pipe.

Properties of Glass Reinforcement

The glass fibers commonly used in reinforcements are made of a borosilicate type of glass commonly referred to as "E" glass. The glass fiber, when drawn, is about 0.0002 in. in diameter; 204 are usually drawn together to make a strand or end. Twenty to sixty ends are then drawn together to form a loosely twisted material for pipe manufacture. Some glass properties in this form are discussed below:

Tensile strength. While calculated theoretical values for the strength of fibrous glass vary from 1 to 14 $\times$ 10^6 psi. (dependent on the theory used), laboratory tests have given values from 0.5 to 0.8 $\times$ 10^6 psi. (dependent upon the care exercised). Probably as high as one can expect from commercial glass, as received from the manufacturer, is 200,000 psi. Further handling, before the final product is formed, could reduce this value to 100,000 psi. Laboratory tests on glass-reinforced pipe show the glass invariably retains a 100,000-psi. figure.

Elastic limit. Within the operating-temperature range of glass-reinforced pipe (GRP), the elastic limit of glass is the same as its ultimate strength; in other words, it possesses true elasticity with no yield. At rupture, elongation is about 3½ %.

Coefficient of thermal conductivity. The low capacity of glass to transfer heat is, of course, well known. The coefficient of thermal conductivity is about 0.06 B.t.u. per sq. ft. per °F. per ft.

Specific gravity. Glass is generally

TABLE 1 — DEMONSTRATED USES OF GLASS-REINFORCED PLASTIC PIPE (Partial Listing)

Fluid transported—	Temp., °F.	Pressure, psi.
Hydrochloric acid, conc'd.	60-260	0-500
Hydrofluoric acid, 10-30%	100-300	0-85
Phosphoric acid, 40-79%	200-300	50-200
Sulfuric acid, 60%	260	30-300
Sulfuric acid, 10-50%	100-290	0-250
Nitric acid, 5%	180	100
Chlorine, dry	90-120	35-75
Brine	40-275	0-1,350
Benzene	80-120	150-500
Xylene	60-200	15.700

Note: The above data are not necessarily applicable to all types of glass-reinforced plastic pipe.

considered a lightweight material with a specific gravity of 2.55.

Pipe Structure

In general, GRP is composed of three materials—glass fibers, plastic matrix, and an inner liner. The glass fibers, which comprise 60-80% of the pipe material, are used as a structural cage and carry a major part of the load. Damage to these fibers can cause serious loss of strength; therefore, most pipes have an inner liner of either polyvinyl chloride or epoxy.

It should be noted here that before the glass fibers can be used as reinforcement, a pretreatment is required. During manufacture of the fiber, sizing and lubricating agents are added to the glass. These keep the fibers together while minimizing effects of the glass abrading upon itself. These agents are usually either removed before application or are designed to dissolve in the particular resin being used.

In addition, a coupling agent must be applied to provide a chemical link between the glass and the resin. The existence of this chemical link, while generally being accepted by most, must yet be conclusively proved. Some recent work, however, strongly substantiates this theory.

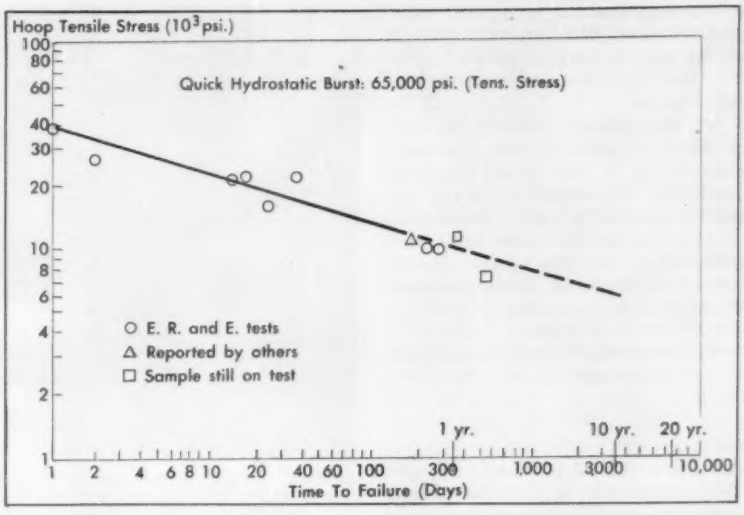
Pipe Manufacture

There are several manufacturers of GRP, each using a different method of fabrication. They roughly fall into two types—external-mandrel wrapping and internal-mandrel casting. The external-mandrel-wrap pipe is made by winding resin-impregnated glass fibers around a polished mandrel and subsequently curing with heat. In the internal-mandrel process, the glass and resin are preplaced inside a mandrel and cast by use of centrifugal force and heat.

In both cases, the glass fibers can be oriented in any direction to provide maximum strength in the direction of maximum load. Fig. 1 shows a cutaway of a typical externally wound pipe, although for any particular manufacturer minor differences are present. Some have no outer cover or inner liner, and glass distribution and orientation may differ.

Pipe Properties

There are no standard schedules for GRP as there are for steel pipe, although the trend is toward standardization on iron pipe o.d. sizes. The plastics are rated by each manufacturer for his particular product. Small-size (2-in. diameter) pipe is currently available that will operate to 1,500 psi. Temperature ranges are from −50° to 300° F.



SUSTAINED PRESSURE TESTS most nearly approximate field conditions, but extreme care must be used in extending the test results up to design stresses. Fig. 2.

Corrosion resistance. The outstanding advantage of plastic pipe is its corrosion resistance. There is, however, the possibility of chemical attack on the plastics resulting in contamination. In most cases, though, this chemical attack also results in the deterioration of the pipe and thus would represent a misapplication. Usually chemical attack on plastic material in the pipe is either suffered rapidly, or the plastic is completely resistant.

On the other hand, attack on the glass-reinforcing or at the glass-resin interface is a more gradual type of degradation. Time is usually required for the reagent to reach the glass and then attack a sufficient amount of glass to cause failure.

The accompanying table lists only a few of the demonstrated uses of GRP showing some of the corrosive fluids that may be handled. This list is only meant to give an indication of the material's chemical resistance and does not necessarily limit the pipe to these conditions. The manufacturer should be consulted for any particular service.

Weight of GRP is about one-fourth to one-fifth that of steel and about two-thirds that of aluminum. This light weight facilitates handling, decreases shipping costs, and results in a faster installation. These advantages become markedly apparent in larger sizes; for instance, 6 or 8-in. plastic pipe can be easily handled by one or two men, whereas power equipment is needed to handle steel pipe.

Flow characteristics. The interior surface of GRP is generally smoother than steel, perhaps approaching that of glass. The Williams and Hazen flow coefficient is in the range of 145-150, whereas steel is about 130. This will yield greater flow through plastic than through steel pipe under the same conditions. Furthermore, the coefficient tends to decrease with time for steel (to about 90) as corrosion occurs, whereas with plastic it remains relatively constant.

Antifouling characteristics. In handling highly paraffinic crudes, wax deposition along metallic pipe walls can be a serious problem. In some oil fields, even though oversized pipe is used, the lines must be cleaned as often as every other day.

By using plastic pipe, the rate of paraffin deposition is radically reduced. In most cases there is no deposit. This is probably due to the smoothness of the pipe, its low thermal conductivity, and its noncompatibility with the wax.

Heat transfer. The low heat-transfer characteristics of plastics are well known. The military is using plastics where skin temperatures are in the thousands of degrees while the interior is relatively cool. Where heated liquids are being transported, the advantage of having a low thermal coefficient in the pipe material is readily apparent.

Pipe strength. Static bursts on 2-in.-diameter pipe have shown ultimates of up to 8,000-psi. internal pressure or 70,000-80,000-psi. tensile strength. However, this is not the complete story. If the 8,000-psi. pipe were held at some lower pressure, say 4,000 psi.,

failure might occur in a very short period of time. The long-term strength of the pipe is quite dependent upon the time, pressure, temperature, and environment.

The only reliable method presently available to predict safe operating pressures is to test under long-term conditions. It is doubtful that any universal correlation for determining long-term properties from short-term tests will be available in the near future; much still must be learned about the mechanisms involved.

Test methods. There are many types of tests currently in use. These include the static or quick hydrostatic burst, pulsating internal pressure (dynamic fatigue), edgewise porosity of the pipe wall, and others. Perhaps the most meaningful is a sustained-pressure (static-fatigue or stress-rupture) test, since it most nearly approximates field conditions.

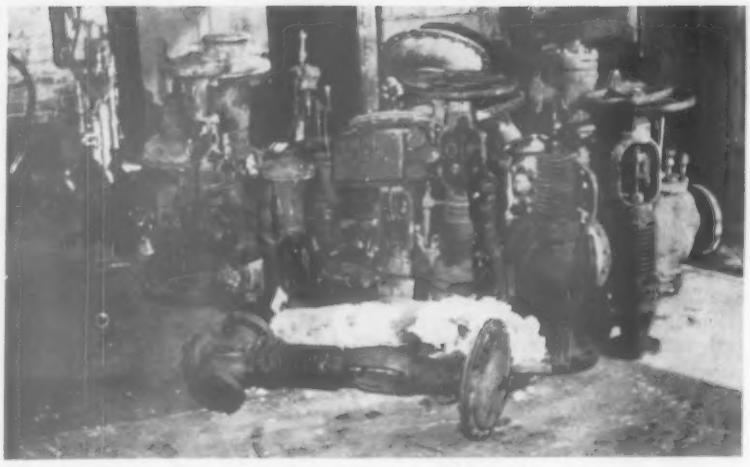
In this test, as run at Esso Research & Engineering Co., the pipes are submerged in a 150° F. water bath, hydrostatic pressure is applied and maintained. The time to failure is recorded. The temperature selection is arbitrary and serves to limit the scope of the test. For a more complete performance picture, the entire temperature range should be covered.

Fresh water is used since this readily attacks the glass-fiber bond. As a matter of fact, distilled water is probably one of the most corrosive fluids the pipe could carry. The water will not only attack the bond, but will actually dissolve glass.

When the results are plotted as a stress-rupture curve on the appropriate coordinates (log-log appears most suitable), the values produce a straight line.

A typical stress-rupture curve is shown in Fig. 2. Each point represents one or more test values. As can be seen, although the pipe will originally fail at a hoop tensile stress of 65,000 psi. under the conditions tested, a 5:1 factor of safety is inadequate. A safety factor of 10:1 to 20:1 is called for (depending on field conditions and length of service required).

One note of caution should be mentioned. Since data of this type are obtained under a fixed set of laboratory conditions, judicious care should be used when extrapolating to design stresses. In addition to reflecting no factor of safety, external stresses produced by bending, overburden, water hammer, local impacts, thermal changes, and others are not accounted for in the results of this test. Since these stresses are additive in most cases, the operating stresses must be adjusted to account for them.



BEFORE. Instead of consigning these fire-demolished valves to the scrap heap, Signal Oil & Gas Co. hired a contractor to recondition them.

AFTER. He cleaned them up like new and they're going into service at only half the cost of new valves.

Fire-damaged valves reconditioned

A VALVE-RECONDITIONING program is saving money for Signal Oil & Gas Co. in its rebuilding program at its fire-ravished Hancock refinery at Signal Hill, Calif.

Of the 134 valves and liquid-level controls needed for the new plant, Signal has managed to salvage 79 from the old plant. These reconditioned pieces include 57 globe-type butterfly valves and 22 liquid-level controls.

The company is saving an average of 50% on the reconditioned valves. B. R. Jones Co., Los Angeles, which is reconditioning the valves, guaranteed Signal it would be able to put the old valves in top shape for a maximum of 75% of the cost of new equipment. But the costs are running 50% or less.

The fire caused varying degrees of damage to the equipment. Some valves had extensive damage; others were hardly damaged. Rubber diaphragms in all the valves were replaced.

In reconditioning the valves, the Jones company followed these steps. The valves were:

. . . Sandblasted to remove exterior rust, gum, and other materials resulting from the fire.

. . . Disassembled and all parts immersed in a hot caustic cleaner to remove interior rust and foreign matter. Any parts damaged were replaced.

. . . Reassembled, tested, and painted.

Signal recently announced it will rebuild the Signal Hill refinery, which has been shutdown since the 1958 fire (OGJ, June 2, 1958, p. 80). The company plans to rebuild the plant with a capacity between 15,000 and 20,000 bbl. daily.

Why sucker rods fail (continued)

BY JOSEPH ZABA

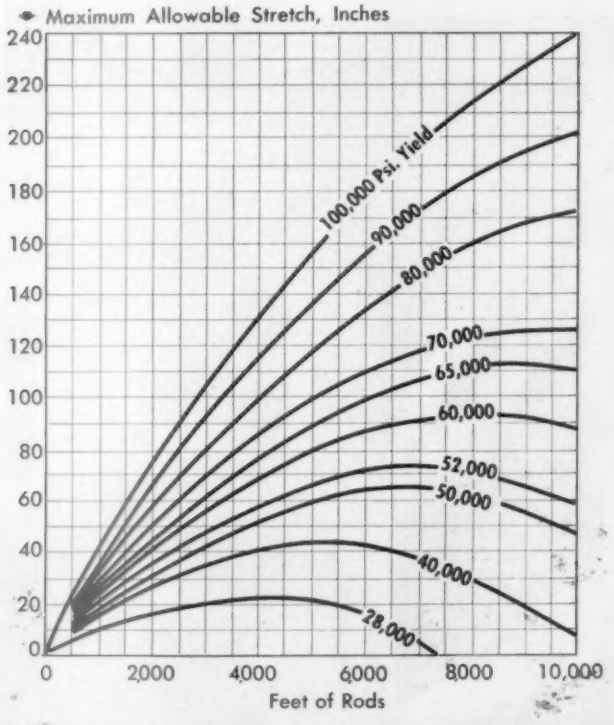
PRINCIPAL CAUSE of sucker-rod body failures is overstressing. Stress normally safe may be increased in intensity by "stress raisers" or additional stresses may be superimposed on the safe stresses, the total exceeding the endurance limit of sucker rods and leading to failure. The mechanism of failure is fatigue, corrosion fatigue, hydrogen embrittlement, or both.

Surface conditions of a sucker rod sharply affect rod performance. Careful cleaning is one of the steps in their manufacture. Improper field handling causes most trouble from stress raisers. Bending of rods followed by straightening creates tensile and compressive stresses on their surface. These stresses may cause a microscopic crack, a serious stress raiser. Nicks and dents caused by hammering or dropping a rod across a sharp object form points of stress concentration, the first step of the fatigue-failure process.

Methods are available for inspection for possible causes of this type of failure of rods, on the rack or at the wellhead. The methods are based on measurement of the pattern of the magnetic flux, induced into the rods, magnetic characteristics of the steel being affected by its physical characteristics. This type of inspection permits grading of rods according to the type of service they are still capable of performing.

The rods may be damaged by drop in a well, resulting from a break, or they may be overstrained beyond the elastic limit in pulling on a stuck pump. One method of checking on overstraining is to use the stretch of rods, caused by the pulling force, as an indication of the amount of stress imposed.[1] Maximum allowable safe stretch of rods of a given minimum yield point for strings of different length is given in Fig. 23.

Additional stresses, which added to the usually safe stresses may result in total exceeding the endurance limit, may be caused by characteristics of the pumping cycle or by faulty operation or characteristics of operation of any of the part of the pumping mechanism. To the first group would belong stresses resulting from the natural vibration of the rods. To the second group would belong stresses caused by fluid pound, those imposed by vibration due to loose bearings of the surface equipment, those caused by the characteristics of operation of the prime mover, and others.



MAXIMUM ALLOWABLE STRETCH of rods of various yield strengths for strings of different lengths. (Copyright, S. M. Jones Co.) Fig. 23.

Sucker-Rod Joint Failures

Causes of sucker-rod joint failures may be divided into the following groups: (1) faulty workmanship or material defects, (2) improper field handling, (3) unscrewing of rods or rod-on-tubing wear, and (4) fatigue or corrosion fatigue. Of the four, the last group contributes most frequently to the failures with fatigue brought about by the preceding three groups of causes and by other factors.

With the trend toward increased allowable working stresses of rods made possible by manufacturing improvement and better corrosion inhibitors, the problem of joint failures became more acute. This has speeded the tempo of study of the subject by a number of investigators. These studies utilized analytical approach, laboratory experiments with plastic models or fully instrumented rod joints, and controlled field tests. The investigators took full advantage of the information available from studies of threaded connections by other industries.

Threaded-Joint Preload

A threaded connection must be "preloaded" if it is to carry satisfactorily an imposed load. In the case of sucker rods the preload is attained by snap-tightening the madeup joint. This places the pin in tension and brings the coupling in compressive contact with the pin shoulder. As long as this contact is maintained the pumping load is carried by the whole joint. When the faces of coupling and of shoulder separate, the pumping load is placed on the pin. Fatigue failure is the usual result.

In an ideal, properly preloaded threaded connection there should be little increase in the loading of the pin with imposition of an outside load. In the case of a sucker rod, however, it has been shown mathematically and experimentally that even in the properly preloaded joint the loading of the pin is substantially increased when the pumping load is placed on the rod

string. The studies of this subject have been ably reported and commented upon in the early fifties by A. A. Hardy, H. M. Cooley, George E. O'Neal, J. C. Slonneger and others.[2 3 4]

More recently W. H. Ritterbusch, Jr., reported on a rather extensive investigation of the subject of preload and makeup torque of sucker-rod joints.[5] The relationship between total pin loading and portion of the pumping load carried by the pin may be expressed by the equation:

$$L_p = L_{pp} + KL_s \qquad (1)$$

Where:

L_p = total pin load, lb.
L_{pp} = pin load due to preload, lb.
$K = A_p/(A_p + A_c)$
A_p = cross-section area of pin thread root diameter, sq. in.
A_c = cross-section area of coupling at major diameter, sq. in.
L_s = applied pumping load, lb.

For any given combination of pin-and-coupling constant K, portions of the pumping load carried by the pin can be calculated. Actually, however, the experiments of the study in question showed the values of K to be higher than calculated. Using the experimental values of K it was found that a pin of a properly preloaded joint carries 42 to 54% of the pumping load, depending on the rod size.

Under condition of theoretically minimum preload the elongation in the coupling resulting from the imposed load equals the compression in the coupling induced by the preload. In such a case $L_p = L_s$ and Equation 2 may be written:

$$L_{ppm} = (1 - K)\,L_s \qquad (2)$$

where L_{ppm} is theoretical minimum preload and other symbols are as in Equation 1.

The concept of the preload of a threaded joint is a theoretical one. It has been here briefly considered to form a background for discussion of a question which is of practical importance, namely, the makeup torque that should be used in making up the rod string in order to attain the needed preload of the sucker rod joints.

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1. T. P. Sanders, "Distortion of Sucker Rods Should Be Avoided When Pulling Stuck Pumps": The Oil and Gas Journal, September 12, 1940.
2. A. A. Hardy, "Sucker-Rod Joint Failures": Drilling and Production Practice, API, 1952, p. 214.
3. H. M. Cooley and George E. O'Neal: Discussion of the above paper.
4. J. C. Slonneger, "A Discussion of Sucker-Rod Pin Stresses": a paper presented at the symposium on sucker rods, API Division of Production midyear standardization meeting, Denver, June 1952.
5. W. H. Ritterbusch, Jr., "What Torque on a Sucker-Rod Joint?": The Oil and Gas Journal, May 4, 1959.

Cooling-tower parts are made of polyethylene

POLYETHYLENE FILL is used in the new No. 3 butyl-unit cooling tower for Esso Standard, Division of Humble Oil & Refining Co., Baton Rouge, La.

It is the first cooling tower in the refinery to use polyethylene fill instead of the more common redwood fill.

Fill for cooling towers is made of many horizontal strips to disperse the water into small drops as it flows through the tower.

Polyethylene fill has several advantages over redwood fill. It increases the tower's capacity, because it can be cut thinner, more horizontal strips can be installed in the same space than with redwood. It is also more durable and requires less maintenance than redwood.

CLOSEUP of polyethylene strips before mounting in butyl unit cooling tower. Fig. 1.

POLYETHYLENE strips are mounted inside the cooling tower as fill instead of redwood. Fig. 2.

How to move a tank in 5 easy steps

A TANK was moved 1,000 ft. by American Oil Co., Texas City, Tex., to help make way for a new 14,000-bbl. per day alkylation unit in its modernization program.

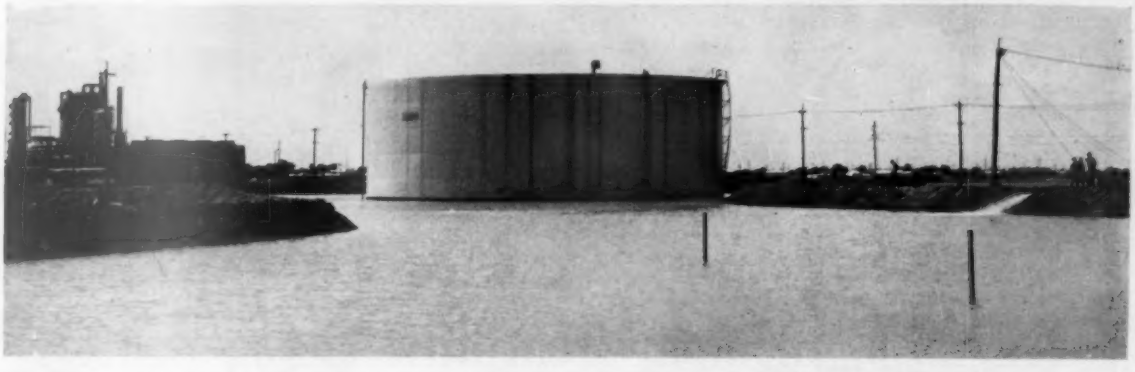
The modernization program also includes a 150,000-bbl. per day crude-distillation unit and a 47,600-bbl. per day fresh feed catalytic cracker (OGJ, May 9, p. 178).

Moving the tank is only one phase of preparation American is making before construction starts on the new units. Other phases include extension of plant utility services, construction of roads and pipeways, and dismantling three storage tanks.

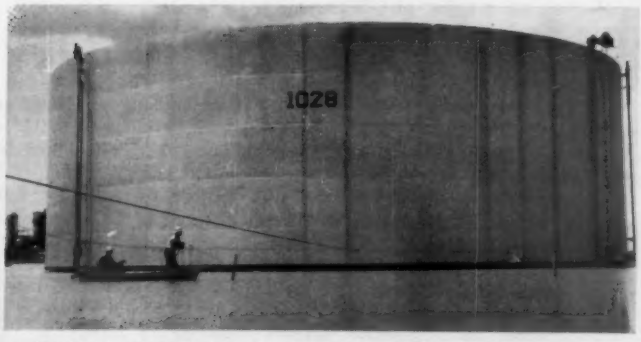
Here in 5 steps is American's tank-moving plan.

1 BUILD A DAM to incompass old and new locations. When dam is completed fill area within dam with enough water to float tank and hitch it to winch trucks. Before pulling send a man to top of the tank to check preparations.

2 BEGIN PULLING when the tank is floating freely. If the wind is blowing hard the movement of the tank may be difficult to control.

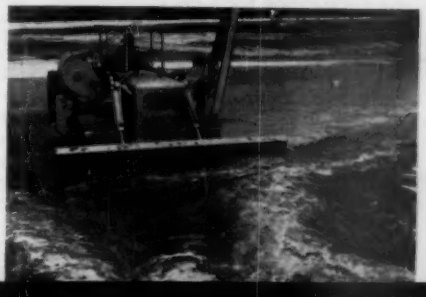


3 NAVIGATE TANK into exact location with a transit. Tank needs alignment with existing piping or an existing tank-farm layout.



4 FOLLOW DIRECTIONS of navigator and ease tank into position. Pipes sticking out of the water show where tank should be placed. Small skiff assists in landing tank correctly.

5 WHEN TANK is in position knock a hole in dam with a bulldozer to let out the water.



In Uruguay

First packaged CO boiler is installed

BY D. H. STORMONT

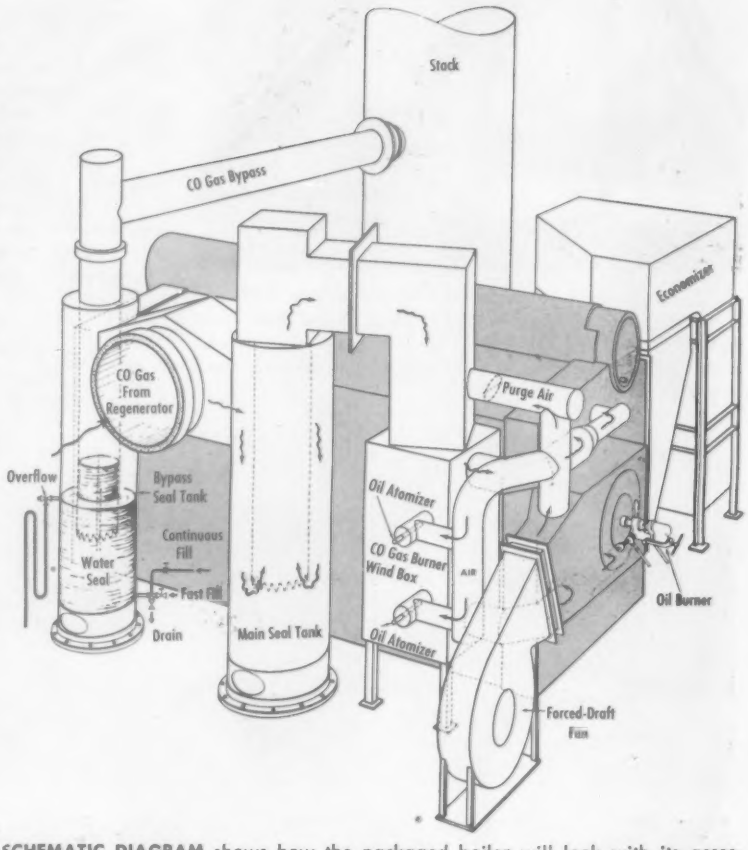
A NEW small "packaged" carbon monoxide boiler will permit small refiners to better approach the heat balances and operating efficiencies now realized only in large plants.

The units will be particularly useful with small catalytic cracking units, because of the large volumes of CO contained in regenerator flue gases. They may also find service with fluid cokers and other such processes discharging hot gases containing CO and unburned hydrocarbons.

The shop-assembled boilers need much less installation time at the plant site, permitting worth-while savings in erection costs.

The first packaged CO boiler is now being installed in the Montevideo, Uruguay, refinery of Administration Nacional de Combustibles, Alcohol y Portland (known as ANCAP). Designed and built by Babcock & Wilcox Co., the unit will operate in conjunction with a new 5,000-bbl. fluid cat cracker. It is the first carbon monoxide boiler installed in the Southern Hemisphere.

Existing standard CO boilers mostly have steam-generating capacities in the range of 200,000 to 450,000 lb. per hour. Design capacity of the ANCAP packaged boiler is 30,000 to 43,000 lb. per hour. Of this volume, about 70% is generated from waste heat and complete burning of CO gases.



SCHEMATIC DIAGRAM shows how the packaged boiler will look with its accessories installed.

Installation. Installation time of the "Pac-Co" boiler is about 4 weeks, as compared with several months needed for the big boilers. As shown in the accompanying photograph and diagram, bulk of the unit is arranged in one 64-ton package. After this unit is in place on its prepoured foundation, addition of accessory equipment, piping, and wiring completes the installation.

Design capacity of the ANCAP boiler when burning both carbon monoxide and atomized No. 6 fuel oil is 30,000 lb. of steam per hour. Of this volume, 23,500 lb. is generated from the otherwise waste regenerator gases. Designed for a pressure of 725 psi., the unit will operate at a steam pressure of 600 psi. and a temperature of 750° F.

Normally the boiler will operate as an integral section of the cat cracker. In the event the cracking unit is shut down, however, the CO boiler can be independently operated on fuel oil. It will produce 43,000 lb. of steam per hour when oil alone is fired. The boiler unit is equipped with Bailey controls for fully automatic operation when firing CO gases plus fuel oil or when firing fuel oil alone.

Sources of heat. Under normal operating conditions, waste gases will be discharged from the regenerator at 1,060° F. An analysis of the flue gas is given in the following table. As shown, 6.29% of the gases (about 68,000 lb. per hour) is carbon monoxide.

Burning of the regenerator flue gas and supplementary fuel-oil charge results in 91,000 lb. per hour of flue gas being discharged from the boiler. These gases, discharged from the economizer at a temperature of 500° F., have a zero combustible content and contain about 2% (by weight) excess oxygen.

ANALYSIS OF REGENERATOR FLUE GAS

	Percentage	
	Weight	Volume
Carbon monoxide	6.29	6.17
Carbon dioxide	12.84	8.03
Nitrogen	67.08	66.0
Oxygen	1.86	1.6
Water vapor	11.93	18.2

Of the 30,000 lb. per hour of steam produced by the boiler, waste-heat recovery will account for 23,500 lb. In other words, the amount of heat recovered which otherwise would be wasted will approximate 28 M.M. B.t.u. per hour. Of the 23,500 lb., approximately 9,250 lb. will come from recovered sensible heat and 14,250 lb. will be due to combustion of CO and entrained hydrocarbons.

Never before such durable tank protection

Old way! Standard type alkyd primer made with conventional pigment particle
Solid
New way! Defense in depth alkyd primer made with M50 pigment
Coated

Proof tank paints with M50® pigment form rust-inhibitive films of outstanding strength and durability

Test panels like these *prove* what paints can do. And these two make it plain that paints containing *M50* basic lead silico chromate—a new National Lead rust-inhibitive pigment . . . form outstandingly strong and durable protective films.

Excepting the pigment, both primers shown on the test panels contain the same ingredients. Both are applied (2.0 mils, dry) on rusted and mill-scaled steel (to increase test's severity). Both have been exposed 12 months in industrial atmosphere (Perth Amboy, N. J.) and 12 months in normal atmosphere (Sayville, L. I.) at 45° South. You can see the effect.

A striking difference! Yet film strengthening proves to be only one of many improvements that *M50* pigment makes in metal protective paints for steel tanks and structures. Now—with new *M50* pigment—your regular paint suppliers can provide metal protective paints with outstanding advantages:

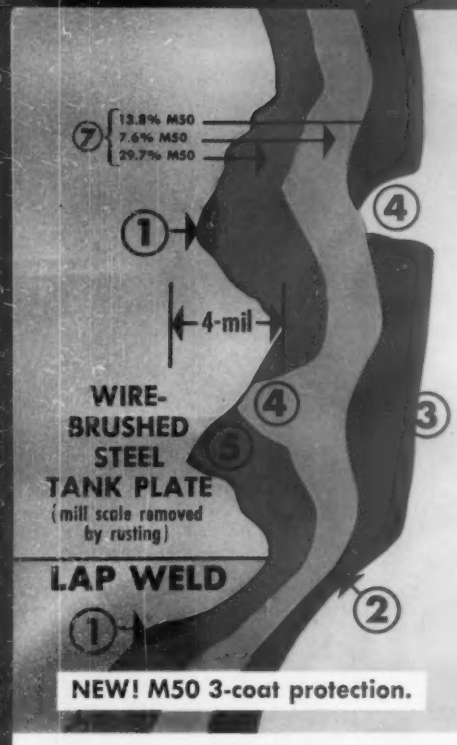
- Weather-resistant anti-corrosive primers.
- Intermediate and finish paints *with* exceptional rust inhibition but *without* bilging hazard in sulfur-laden atmospheres.
- Finish paints in a wide range of decorative colors that don't fade or wash out.
- Alkyd-type conventional and deep-coat paints with outstanding durability, package stability and sprayability.

What makes the difference? Basically the differences that make a difference in *M50* pigmented paints are inherent in the unique *M50* coated pigment particle itself (idealized particle shown above.) See, on the next page, the extra protections the *M50* particle provides in the dried film. See, too, how you can get the benefits of these new, much more durable, anti-corrosive paints.

M50 *an* **oncor** TRADEMARK *pigment development of*

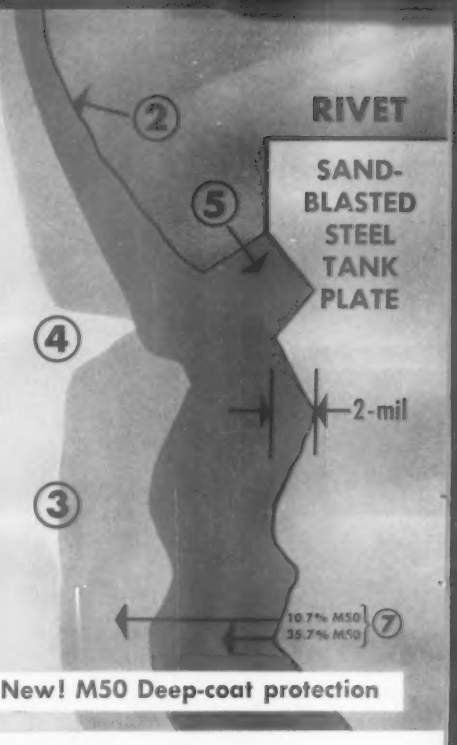
National Lead Company

111 Broadway, New York 6, N. Y.



NEW! M50 3-coat protection.

1. **Pockets of rust prove less harmful** on steel surfaces painted with conventional *M50* paints. Vehicles penetrate and isolate existing rust. *M50* particles stop rusting action.
2. **Where paint film lies thin** over tiny surface projections and sharp structural edges, the *rust-inhibitive* pigment content in all coats of *M50* paints provides extra protection.
3. **Just-right flow characteristics of** package-stable *M50* paints aid leveling on rough steel surfaces, promote smoothness, good appearance.
4. **Inevitable "holidays" in film** do not destroy protection. Again, *all M50* coats have both rust inhibition *and* weather resistance.
5. ***M50* paints "wet" well,** penetrate pits and crevices, carry *M50* protection to every part of these danger spots.
6. **Lightweight *M50* particle** aids formulation of new type deep-coat paints with *uniform* rust inhibition throughout the film and low sag characteristics.
7. **Every coat can have rust inhibition**—not just the primer. Note percentages of *M50* in dry films. What's more, for equal weights of corrosion-inhibitive pigment, *M50* primers contain 40-60% more corrosion inhibition by volume than non-*M50* primers.



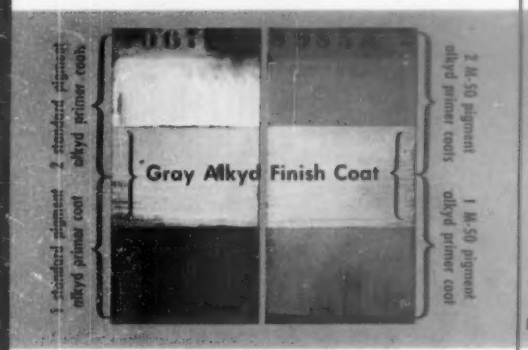
New! M50 Deep-coat protection

Sections through M50 Defense in Depth films show dramatic extra protection these new tank paints provide

Information on the preceding page proves that *M50* pigment paints form stronger protective films than anti-corrosive paints made with other rust-inhibiting pigments. The sections above show some of the ways in which these new paints perform better in the dry film. Below you will see *proof* that *M50* metal protective paints don't bilge, are unique for color stability and the color range in which they can be made.

Hold the *M50* pigment particle itself responsible for all these improvements . . . *Basic lead chromate* is known for exceptional rust-inhibiting action. In the *M50* particle, this reactive business portion of the particle is coated on an inert core . . . where *all of it is available* to react. The coating is *fused* on—shows superior resistance to chalking, erosion, chemical action. Unusual tintability is due to the geometric configuration of the coated silica particle.

Why M50 Defense in Depth paints give anti-corrosion beyond all former concepts

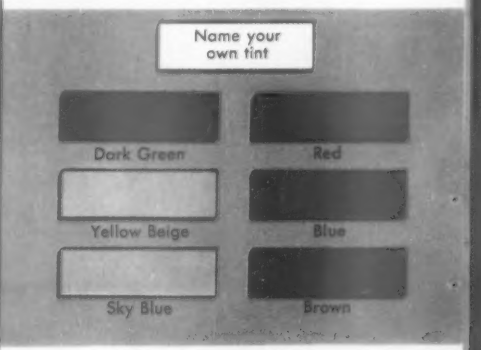

2 standard pigment alkyd primer coats
2 M-50 pigment alkyd primer coats
Gray Alkyd Finish Coat
1 standard pigment alkyd primer coat
1 M-50 pigment alkyd primer coat

Exposed 9 years, 45°S. Each coat 1.5 mils

Proved corrosion and weather resistance

Exposed 4 years adjacent to refinery

Proved anti-bilging performance



Available in conventional and heavy-coat paints

Proved stability in wide range of colors

Are you concerned with tank or structure maintenance painting in your firm? If so, you are invited: (1) to visit National Lead's Sayville, L.I. test station, where you will see the results of the 20 years research that lies behind the *M50* pigment particle and the more than 10 years of exposure testing that lies behind *M50* pigment Defense in Depth paints; (2) to send coupon below for National Lead booklet, "Defense in Depth" and typical *M50* tank paint specifications.

Next time you purchase, specify *M50* pigment paints. Any paint manufacturer can supply you.

M50 Defense in Depth

National Lead Company,
111 Broadway, New York 6, N. Y.

Gentlemen: Please send me the "Defense in Depth" booklet together with typical tank paint formulas and color chips that I can use in specifying M50-type tank paints.

Name_____ Title_____

Firm or Dept._____

Address_____

City_____ State_____

Learn how to anticipate trouble on drilling wells

Here's how to predict problems, and how to determine their costs when they come, as come they surely will

ANY COMPANY which drills even a moderate number of deep wells in South Louisiana can expect to pay out additional money above the amount it anticipates simply to drill.

This additional expense results from fishing jobs, gas kicks, salt-water flows, loss of circulation, and other common drilling hazards. While the time and place these problems strike cannot be predicted exactly, they must certainly be expected.

Presented here is a method of predicting with some accuracy the amount of trouble to be expected and how much it likely will cost. Although this survey is for South Louisiana only, a similar procedure could be used in other areas.

Say, for example, a company plans to drill twenty 12,000-ft. wildcat wells in some year. Experience may show that 20% of all holes drilled to 12,000 ft. in the area can expect serious trouble. If the average "serious trouble" costs about $20,000, then $80,000 should be set aside in some manner to cover the contingencies.

That amount of risk money should be put in the budget for the year.

What is the average cost for serious trouble? Such a figure is difficult to arrive at. The range could be from $5,000 to several million dollars in the case of a wild well. However, most companies are protected by insurance from great calamities such as fires.

So, the range of trouble expense in South Louisiana is probably from $5,000 to $250,000 in most cases.

BY L. E. WILSON

. . . senior drilling engineer in the Lafayette, La., regional office of Atlantic Refining Co. He has been with Atlantic since 1950, and held positions as drilling engineer and drilling supervisor before being promoted to his present position in January 1960. Wilson was graduated from Tulsa University in 1950, with BS degree in petroleum engineering.

How much trouble in South Louisiana?

The most significant statistic in this survey is the percentage of wells having serious trouble at various depths.

Depth (ft.)—	Wells drilled	Wells reporting serious trouble	%
10,000-11,000	221	29	13.1
11,000-12,000	226	57	25.2
12,000-13,000	216	72	33.3
13,000-14,000	205	75	36.6
14,000-15,000	127	55	43.3
15,000-16,000	96	54	56.2
Over 16,000 (average depth 16,806)	70	50	71.4
All wells below 10,000	1,161	392	33.7

There is a somewhat dampened rate of increase in troubles at 14,000 ft. Reason for this is the weight of numbers of routine, trouble-free development wells drilled to this depth in such areas as Weeks Island, Calliou Island, and Bastian Bay. It is obvious well troubles increase rapidly with depth.

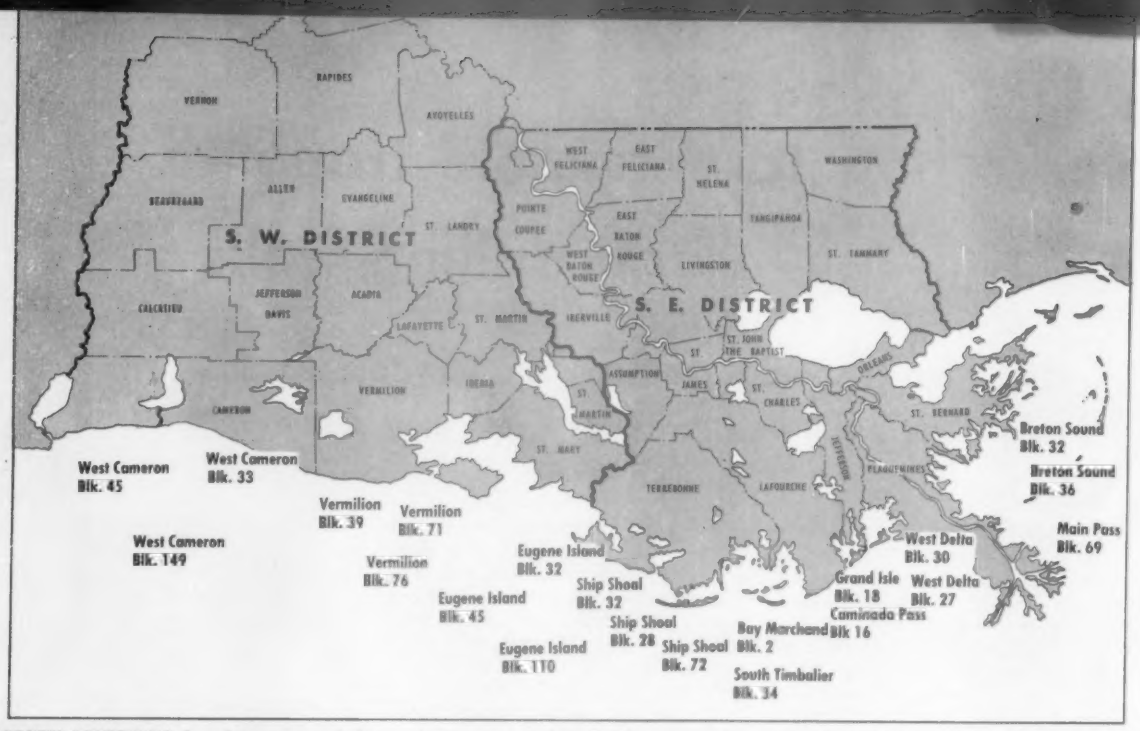
Cost of trouble also increases rapidly with depth. A fishing job at 10,000 ft. may cost $10,000, while a similar job at 16,000 ft. might be $50,000. It is this increased cost that prompts sidetracking in deeper holes, often without an attempt to recover the fish.

Several drilling contractors use $20,000 as an average figure. This amount will usually pay for backing off stuck drill pipe, plugging back, and sidetracking to the bottom of the original hole.

Some companies may use $50,000 or higher as a better figure for the average cost of serious trouble.

Troubles grow with depth. Object of the survey given here is to correlate the trouble encountered with depth drilled. Everyone realizes that the deeper a well is drilled, the greater the chance of serious trouble. But, just how deep and how much trouble are often matters of guesswork. This survey does not eliminate the guesswork, but it does give a historical basis for the guess.

To make predictions more accurate, it's necessary to have some history as a basis. The year 1959 is as good an average as any, as far as well troubles are concerned. And this survey includes all wells completed or abandoned in South Louisiana during calendar 1959.



SOUTH LOUISIANA has been one of the nation's most active drilling areas for a number of years. That's why anticipating trouble in this area is an important job, particularly in deep wells. Surveys of trouble cover this area, in both southeast and southwest districts. Fig. 1.

Such an area-wide survey is naturally not as accurate as a survey of only those wells immediately surrounding the new location. Still, the weight of numbers often is more valuable than only a few adjacent wells. This is especially true where there is a high degree of faulting.

Let us specify exactly the area we are to cover. It is the South Louisiana area bounded on the west by the Sabine River, on the south by the Gulf of Mexico, on the east by the State of Mississippi, and on the north by the State of Mississippi and the northern parts of Vernon, Rapides, and Avoyelles parishes, Louisiana.

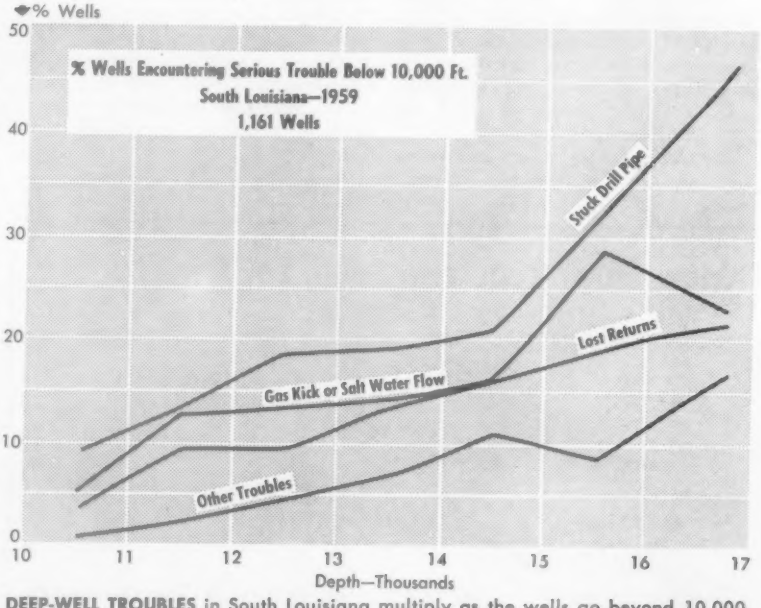
Then, let us divide this large area into its two usual districts. The Southeast Louisiana district includes all of St. Bernard, Orleans, St. John, Plaquemines, Jefferson, St. Charles, St. James, Lafourche, Assumption, Terrebonne, Ascension, St. Tammany, Washington, Tangipohoa, St. Helena, Livingston, E. Feliciana, W. Feliciana, E. Baton Rouge, W. Baton Rouge, Pointe Coupee, and Iberville parishes.

The Southwest Louisiana district includes all of St. Mary, St. Martin, Iberia, Lafayette, St. Landry, Avoyelles, Evangeline, Vermilion, Acadia, Allen, Jeff Davis, Cameron, Calcasieu, Beauregard, Vernon, and Rapides parishes.

No offshore wells are included in the survey.

The two districts are shown in Fig. 1.

Source of data. The survey includes all wells completed or abandoned in



DEEP-WELL TROUBLES in South Louisiana multiply as the wells go beyond 10,000 ft. The percentage of wells reporting trouble around the 14,000-ft. mark levels out because of development drilling in a number of fields at this depth. Fig. 2.

TABLE 1—WELLS COVERED IN SURVEY

	SW La. district	SE La. district	Total	% of total
Number of wells completed or abandoned to all depths	1,045	936	1,981	100.0
Depth range of wells completed or abandoned in 1959, ft.:				
0-10,000	499	321	820	41.4
10,000-11,000	100	121	221	11.2
11,000-12,000	101	125	226	11.4
12,000-13,000	109	107	216	10.9
13,000-14,000	96	109	205	10.3
14,000-15,000	68	59	127	6.4
15,000-16,000	48	48	96	4.8
Over 16,000 (avg. depth 16,806)	24	46	70	3.6

Only a paint brush and solvent cement are needed to join Butyrate pipe.

Thanks to its light weight, pipe of Tenite Butyrate is easy to handle.

Pipe of Tenite Butyrate plastic means less downtime

As any oilman knows, metal flow lines carrying high paraffin crudes can completely plug in a very short time. Result: costly maintenance plus the loss of valuable production time.

Nearly ten years ago, some enterprising oilmen decided to do something about this problem and began to use pipe of Tenite Butyrate plastic for their operations. The inner wall of this pipe has an extra-smooth surface that discourages the accumulation of paraffin.

Since then, millions of feet of Butyrate plastic pipe have been installed by the petroleum industry. Users report many benefits.

Here's pipe that resists paraffin plugging

Butyrate pipe is virtually non-corrodible. It withstands the attack of sour crudes, salt water, and alkali soils.

Butyrate pipe gives greater flow volume. Smooth walls mean less load on pumps.

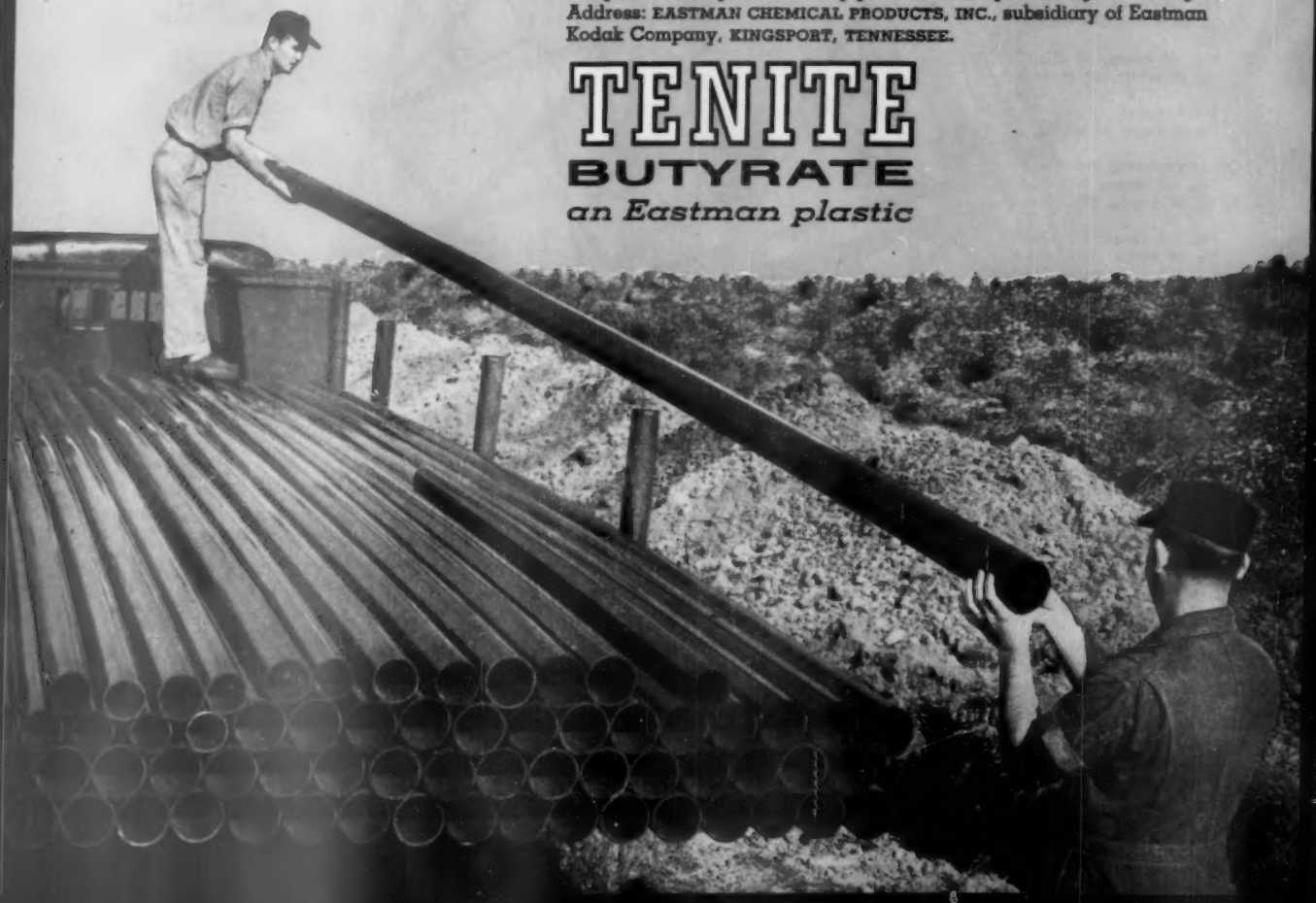
Butyrate pipe is tough. It can take rough handling and all normal backfilling operations.

Butyrate pipe is light. A 20' length of 4" pipe weighs only 20 lbs.

Butyrate pipe is easily joined. You just solvent-weld slip-sleeve couplings to the pipe ends. Any cutting can be done with an ordinary hand saw.

Couldn't this pipe be of help to you, as it has been to other oilmen for nearly a decade? Write us for additional information and the names of companies that produce the pipe and a complete range of fittings. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE
BUTYRATE
an Eastman plastic



the calendar year 1959. Some of these wells may have been drilled several years before but were not originally completed until 1959.

Old wells which were drilled deeper are included if any substantial amount of hole was drilled below the protection pipe or surface pipe. Wells shallower than 10,000 ft. are not included unless they were originally proposed deeper than 10,000 ft. and the hole was lost above 10,000 ft.

Directional holes and sidetracked holes are included in the survey but are reported as one well only, regardless of number of holes drilled.

Table 1 summarizes the wells reported.

Data for the survey come from Atlantic Refining Co.'s original scout tickets kept on each well drilled in South Louisiana and from electric logs run on these wells. Only about 77% of the electric logs are available

TABLE 2—SOUTH LOUISIANA DEEP-WELL TROUBLES

	Ft.						
	10,000 to 11,000	11,000 to 12,000	12,000 to 13,000	13,000 to 14,000	14,000 to 15,000	15,000 to 16,000	16,000 and over
Wells drilled (1,161 total):							
SW district	100	101	109	96	68	48	24
SE district	121	125	107	109	59	48	46
Total, South Louisiana	221	226	216	205	127	96	70
Lost returns:							
No. of cases, SW district	5	10	10	16	9	8	7
% of wells, SW district	5.0	9.9	9.2	16.7	13.2	16.6	29.1
No. of cases, SE district	3	9	9	9	11	11	8
% of wells, SE district	2.5	7.2	8.4	8.2	18.6	23.0	17.3
Total cases	8	19	19	25	20	19	15
Percentage of wells	3.6	8.4	8.8	12.2	15.7	19.7	21.4
Gas kicks or salt-water flows:							
No. of cases, SW district	9	10	15	13	8	12	5
% of wells, SW district	9.0	9.9	13.7	13.5	11.7	25.0	20.8
No. of cases, SE district	2	18	14	16	12	15	11
% of wells, SE district	1.6	14.4	13.0	14.7	20.4	31.3	24.0
Total cases	11	28	29	29	20	27	16
Percentage of wells	5.0	12.4	13.4	14.1	15.7	28.1	22.8
Stuck drill pipe:							
No. of cases, SW district	9	14	19	17	13	14	12
% of wells, SW district	9.0	13.9	17.4	17.7	19.1	29.1	50.0
No. of cases, SE district	11	15	20	23	15	18	20
% of wells, SE district	9.1	12.0	18.7	21.1	25.4	37.5	43.5
Total cases	20	29	39	40	28	32	32
Percentage of wells	9.0	12.8	18.0	19.5	22.0	33.3	45.7
Other reported trouble:*							
No. of cases, SW district	1	4	8	6	10	5	3
% of wells, SW district	1.0	3.9	7.3	6.2	14.7	10.4	12.5
No. of cases, SE district	1	1	2	8	4	3	9
% of wells, SE district	0.8	0.8	1.8	7.3	6.8	6.2	19.6
Total cases	2	5	10	14	14	8	12
Percentage of wells	0.9	2.2	4.6	6.8	11.0	8.3	17.1
Total wells reporting serious trouble:							
No. of cases, SW district	15	27	36	34	28	27	18
% of wells, SW district	15.0	26.7	33.0	35.4	41.2	56.2	75.0
No. of cases, SE district	14	30	36	41	27	27	32
% of wells, SE district	11.6	24.0	33.6	37.6	45.7	56.2	69.6
Total cases	29	57	72	75	55	54	50
Percentage of wells	13.1	25.2	33.3	36.6	43.3	56.2	71.4

*Such as stuck casing or liner, fishing for junk, accidental sidetrack, casing failures, etc.

TABLE 3—RESULTS OF FISHING FOR DRILL PIPE

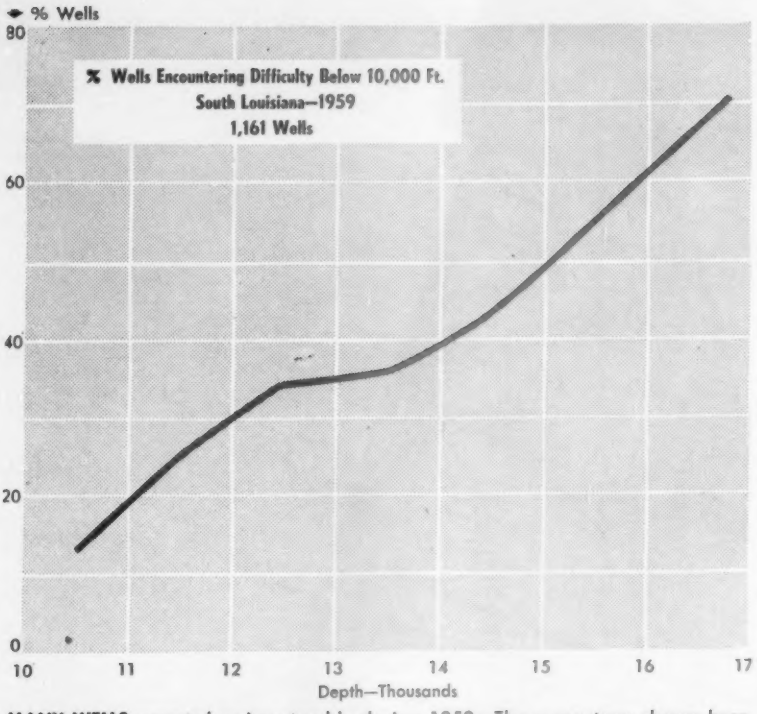
	SW La. district	%	SE La. district	%	Total all wells	%
Wells that stuck drill pipe	98		122		220	
Wells that restuck drill pipe after cleaning out or sidetracking	25	25	21	17	46	21
Wells that stuck washpipe (as per cent of wells with stuck drill pipe)	15	15	4	3	19	9
Stuck strings of drill pipe	126	100	149	100	275	100
Completely recovered	49	39	53	35	102	37
Sidetracked or partially recovered and sidetracked	34	27	55	37	89	32
Completed through drill pipe, or plugged back and completed higher	10	8	16	11	26	10
Abandoned hole (junked or economically not feasible to continue)	33	26	25	17	58	21

Drill Barge in Buras Levee Uses Bethlehem Wire Rope. When photographed, this barge rig was drilling in the Buras Levee District 7 Field, near Empire, La. The operator, Sharp Gulf Drilling Co., drilling for Pan American Petroleum Corp., reported good service from a 1½-in. Bethlehem rotary line... 6 x 19 Formset Purple Strand, right lay, with IWRC. Bethlehem Wire Rope provides good service because it is engineered for the job. That's why it pays for itself many times over in ton-miles logged—a matter of logic known to thousands of successful operators in the oil country.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

Wire rope mill depots and distributors from coast to coast stock Bethlehem Rope

BETHLEHEM STEEL



MANY WELLS reported serious trouble during 1959. The percentage shown here is not the sum of the individual troubles shown in Fig. 2. Reason is that some wells had more than one kind of trouble, such as lost circulation and stuck pipe in the same hole. Fig. 3.

from the Atlantic files, so mud weight and type are not available on all wells.

Location, operator, casing program, depth reached, and trouble encountered are taken from the scout tickets; mud weight and mud type are from the electric log.

In all, 1,981 wells were examined.

TABLE 4—MUD TYPES BELOW 10,000 FT.

	SE La. district	SW La. district	All wells	% of total wells	% of wells broke over
Total wells below 10,000 ft.	615	546	1,161	...	...
Number of wells with mud type reported	445	448	893	...	...
Number of gel muds	143	150	293	...	...
Number of broke-over muds	302	298	600	...	...
Gel muds:					
Gel	121	96	217	...	...
Gel oil emulsion	22	54	76	...	...
Total	143	150	293	33	...
Lime-base muds:					
Lime base	61	38	99	...	...
Lime base-oil emulsion	48	114	162	...	...
Total	109	152	261	29	44
Gyp muds:					
Gyp	65	29	94	...	...
Gyp oil-emulsion	55	75	130	...	...
Total	120	104	224	25	37
CaCl muds:					
CaCl	56	17	73	...	...
CaCl oil-emulsion	12	17	29	...	...
Total	68	34	102	12	17
Other muds:					
Salt-water gel	2	4	6	...	...
Sodium surfactant	1	0	1	...	...
Other	2	4	6	...	...
Total	5	8	13	1	2

Of these wells, 1,045 were drilled in the southwest district and 936 were drilled in the southeast district.

Not all the story. In most cases the scout ticket does not tell the complete story. A well may have serious difficulty, such as stuck drill pipe, lost returns, salt-water flows, or gas kicks, and not be reported. The usual scout check is on a weekly basis, and if there is trouble which is overcome between scout checks, it is often not reported.

On the other hand, some difficulties which may be reported on the day of the scout check could be minor in nature, such as a gas kick or lost returns. Drill pipe could sometimes be stuck and recovered between scout checks and not reported. However, serious trouble that continues for more than 1 week is usually caught on the report.

Probably 90% of the stuck-drill-pipe cases were reported since they show up as a sidetracked hole or last until the next scout check. On the other hand, probably only 25% of the lost returns cases are reported since, if they are not actually losing returns on the day of the scout check, no report of the loss is made.

To confirm this limitation, a check was made on drillers' logs of several of the wells which did not report trouble. It was found that lost returns, gas kicks, and even stuck drill pipe had actually occurred but were not reported on the scout check.

For consistency of reporting, all gas kicks, lost returns, salt-water flows, fishing jobs, or other usually serious difficulties were assumed to be serious if they appeared on the scout report. This is not always true, but the serious troubles not reported probably offset the minor difficulties that are reported.

Table 2 and Figs. 2 and 3 show the types of trouble and the depths of wells reporting the trouble.

Result of fishing. Wherever a string of drill pipe was stuck, the subsequent fishing job was followed up to determine the outcome. Fig. 4 is the result. As shown in Table 3, the number of stuck strings is greater than the number of wells that reported stuck drill pipe. This is because of repeated sticking in the same hole.

The number of holes abandoned after sticking drill pipe include those junked, as well as those not economically feasible to continue. It is not possible to distinguish between the two in many cases.

In some cases wells are deepened below a producing sand, and when the drill pipe is stuck, no attempt is made to recover it. These wells are

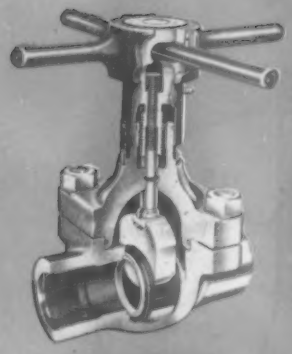


Figure 2126 Resilient Seat Gate Valve. 2", 3", 4", 2000 lb W.P. EValcoat protective Plastic Coating.

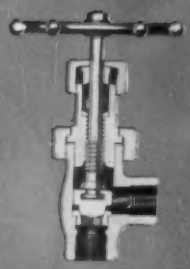


Figure 2699 Forged Steel Angle Valve. ½", ¾", 1", 2000 lbWOG. Not Plastic Coated.

Figure 132J Forged Steel Gage Valve. Size ½", 4000 lb WOG. Not Plastic Coated.

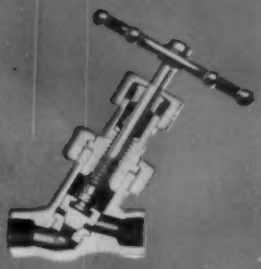


Figure 2696 Throttle Disk Forged Steel Globe Valve. Size 1", 2000 lb WOG. EValcoat Plastic Coating.

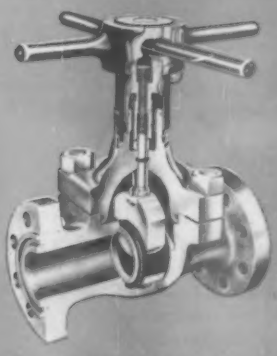


Figure 3116 Resilient Seat Gate Valve. 2", 3", 4", 2160 lb W.P. EValcoat protective Plastic Coating.

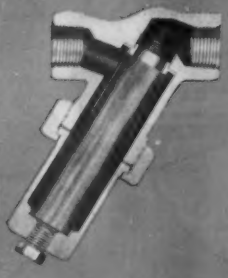


Figure 126 Forged Steel Strainer. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

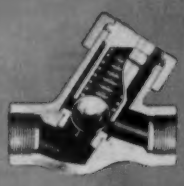


Figure 2676 Forged Steel Check Valve. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

Figure 448 Forged Steel Globe Valve. 1½", 2", 2000 lb WOG. Not Plastic Coated.

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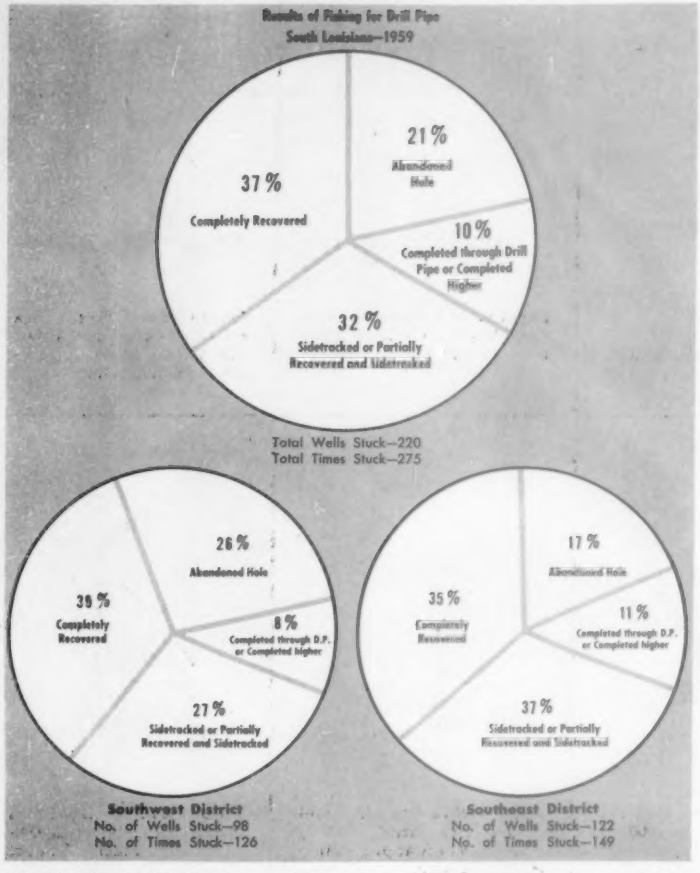
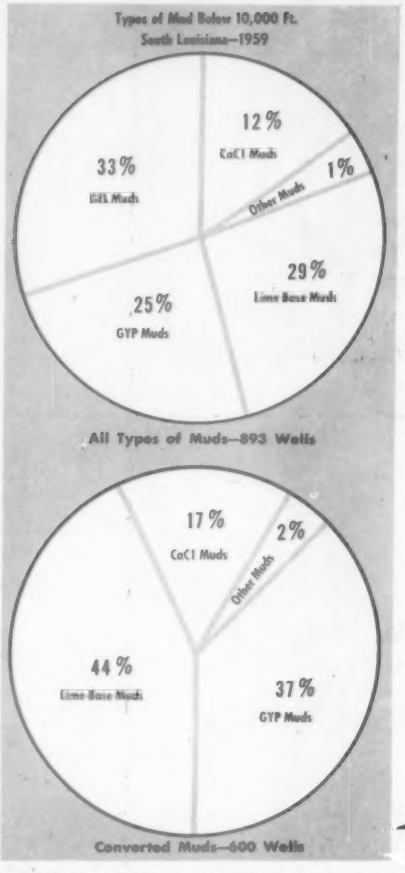


AN ALARMING NUMBER OF WELLS which stuck pipe did not completely recover the fish. As figures show, the average number of cases of stuck pipe is more than one for each well. Fig. 4.



HIGHLY TREATED and up-to-date muds haven't erased drilling problems in South Louisiana. These mud types are those reported on the last log run in the well. Fig. 5.

included in the statistics as "plugged back and completed higher."

Incidence of wells that stuck washpipe is based on the number of wells that stuck drill pipe rather than the number of strings of stuck drill pipe.

What about mud? Information on the drilling fluid was taken from the last log run on the well. The well may have been drilled deeper but perhaps later troubles ruled out a deeper log. At any rate, mud weight and type are those reported on the deepest log run. In almost all cases this agreed closely with reported total depth.

Mud type is also taken from the logs, but there are some discrepancies here due to an inadequate description of the mud. However, by examining the pH and mud ingredients, mud type could usually be determined.

About 77% of the total wells below 10,000 ft. report mud types and mud weights, so the percentage breakdown by mud type, although not complete, should be representative. Fig. 5 shows this breakdown.

Commonest headache. Lost returns is probably the number one trouble maker in deep drilling, although the statistics do not give it that spot. When returns cannot be maintained with mud weights sure to hold reservoir pressure, drilling must proceed with reduced mud weights. At these reduced weights, gas kicks and saltwater flows often occur. These, in turn, are the principal causes of most of the stuck strings of drill pipe.

Minor losses of mud are seldom reported on the scout checks, but they are an indication weight cannot be increased further. Consequently, formations are drilled without a hydrostatic head much above formation pressures. Result is often an expensive fishing job.

At present, the only sure cure for lost circulation is casing.

Don't miss this one . . .

Direct Truck Takeoff at Unattended Station

That's what Indiana Standard is doing at its Trenton, Mo., terminal, and the company will build others like it at St. Joseph, Mo., and Constantine and Girard, Mich. A fifth terminal, that at Cedar Rapids, will be able to deliver directly from the line into trucks, but it will also have some tankage.

This issue, page 92

27. How to find interstitial-water saturation

. . . from electric-log data

BY E. T. GUERRERO
and
F. M. STEWART

GIVEN: Electric log showing the SP, normal, and lateral curves for a clean sandstone formation.

FIND: Interstitial-water saturation in the interval 7,185-7,200 ft.

METHOD OF SOLUTION: In his paper "The Electrical Resistivity Log as an aid in Determining Some Reservoir Characteristics," Archie[7] suggests this empirical relationship:

$$S_w = (R_o/R_t)^{1/2}$$

Where:

S_w = interstitial-water saturation, fraction of pore volume

R_o = resistivity of formation when 100% saturated with connate water

R_t = true resistivity of formation, ohm m^2/m

SOLUTION: Fig. 1 shows the SP and resistivity curves for the formation under study. The log shows the characteristic resistivities of a thick sandstone having an oil pay underlain by a water zone. Note that the resistivity for the long normal, $R_{64''}$, has been read as 7.4 in the pay and 0.2 in the water sand. Both of these values are apparent resistivity values. Other data recorded on the log are as follows:

H = gross pay thickness for the oil zone, = 14 ft.

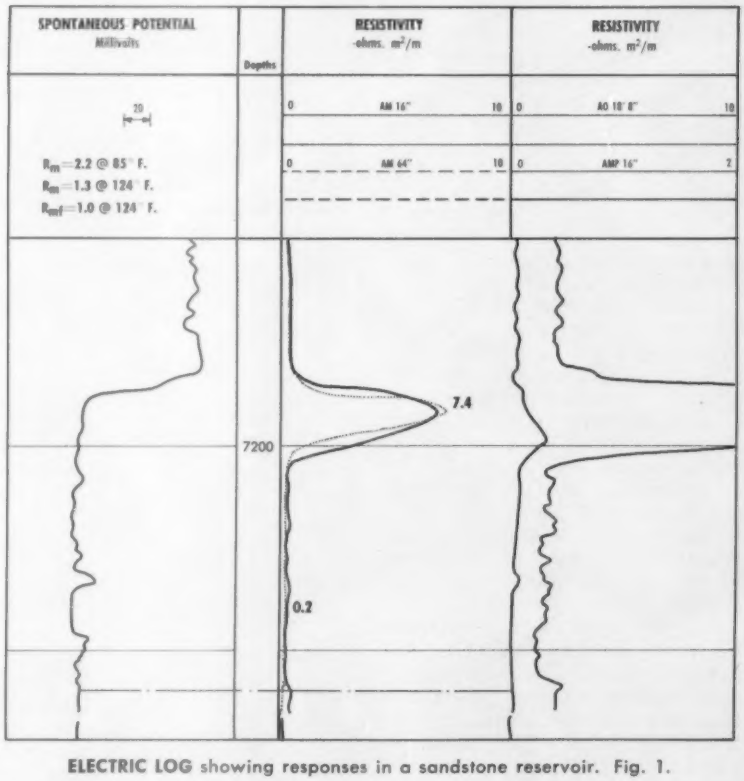
R_m = resistivity of mud at formation temperature, 124° F. = 1.3 (often not given at formation temperature but can easily be converted to same by referring to Chart A-6 of Reference 5).

R_s = resistivity of surrounding shale beds ≈ 0.3

Gross bed thickness for water zone is greater than 20 ft.

TABLE 1[1]—ESTIMATION OF TRUE RESISTIVITY FROM 64 IN. NORMAL IN RESISTIVITY BEDS

Gross bed thickness	($R_{16''}/R_m \leqq 10$, Invasion $\leqq 2$ dia.) Necessary conditions	Estimated R_t
H > 20 ft.		$R_t = R_{64''}$
H ≈ 15 ft.	$R_m \approx R_s$, $R_{64''}/R_s \geqq 2.5$	$R_t = 1.5\ R_{64''}$
H ≈ 15 ft.	$R_m \approx R_s$, $R_{64''}/R_s \geqq 1.5$	$R_t = R_{64''}$
H ≈ 10 ft.	$R_m \approx R_s$, $R_{64''}/R_s \geqq 2.5$	$R_t = 2\ R_{64''}$
H ≈ 10 ft.	$R_m \approx R_s$, $R_{64''}/R_s = 1.5$	$R_t = 1.5\ R_{64''}$



ELECTRIC LOG showing responses in a sandstone reservoir. Fig. 1.

Thus in the oil pay

$$R_{64''}/R_s = 7.4/0.3 = 25$$
$$R_{16''}/R_m = 6.8/1.3 = 5.2$$

From Table 1, estimated values of the true resistivities in the oil sand can be found to be:

$R_t \approx (3/2)\ R_{64''} = (3/2)\ (7.4) = 11.1$

and in the water sand

$$R_t \approx R_o = R_{64''} = 0.2$$

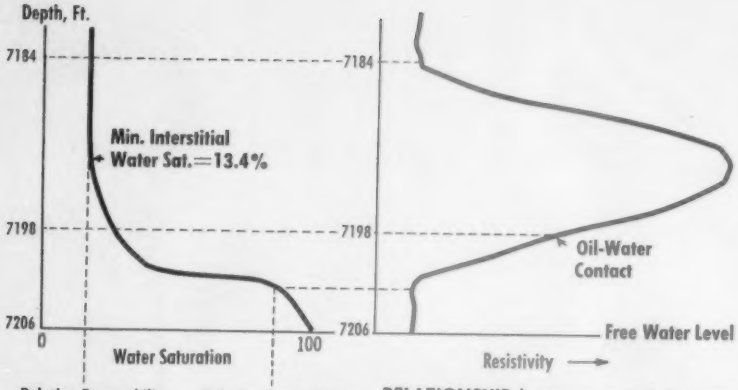
Therefore

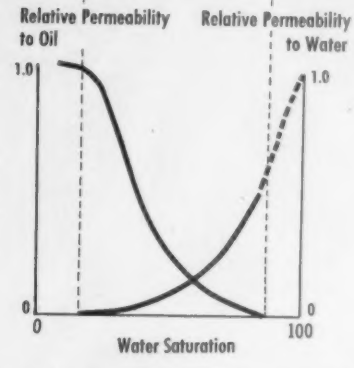
$$S_w = (0.2/11.1)^{1/2} = (0.018)^{1/2} = 0.134$$

or 13.4%

DISCUSSION: Data needed to find reserves and reservoir performance can be obtained by direct or indirect methods. The former involves measurement of the desired property on samples of the rock, fluid, or combined rock-fluid system. In the indirect method a relationship between the desired property and a measurable secondary property is established[2].

This problem is a good example of the indirect method in that interstitial-water saturation is related to the resistivities of the in-place rock. The latter are measured and used to com-





RELATIONSHIP between resistivity, capillary pressure and relative permeability curves. Fig. 2.

pute the per cent of water saturation.

Required in the solution are the true resistivity (R_t) of the rock and the resistivity of the same media when 100% saturated with formation water (R_o). True resistivity is an intrinsic property of a rock and is absolutely independent of the manner used to make the electrical measurements.[3] The instruments used do not measure true resistivity but an apparent resistivity which is affected by several factors in addition to the true resistivity.[3] These factors are mud resistivity, hole diameter, type and spacing of electrode assembly used, bed thickness, filtrate invasion, and resistance of adjacent beds. The presence of a normal drilling fluid may cause current to escape up and down the hole, tending to reduce the indicated resistivity of a bed. The effect is greatest for small electrode spacing, a minimum for large spacings.

Type and spacing of electrode assembly is important because for any set of conditions (hole size, resistivity of mud, filtrate invasion, etc.) one electrode arrangement may measure much closer to the true resistivity than another.[4] Table 1 shows combinations of conditions where the long normal curve may be used. Other sets of conditions where the short normal and lateral curves may be used to estimate true resistivity are presented in the literature.[5]

When the bed under study is reasonably homogeneous and thick, R_t is given by the lateral and long normal curves, if the invasion is moderate, or by the lateral if the invasion is deep. In the case of thin beds, the short normal curve may give the best approximation to R_t, but it may be difficult to determine R_t with assurance of reasonable accuracy.

It has been found that the apparent and true resistivities differ more and more as a bed becomes thinner. This is caused by the effect of adjacent formation resistivities. Still other factors are the size and resistivity of the filtrate invaded zone and lithologic or formation changes.

This brief discussion shows the trouble met in finding true resistivities from apparent-resistivity measurements. Theoretical and laboratory research, along with mathematical work on ideal systems, has led to new methods for estimating true resistivity from apparent resistivity measurements. The two principal approaches are the one used in this problem[6] and one using departure curves (examples of which are Charts B-2 and B-4 of Reference 5). Both methods are applicable under specific conditions and occasionally conditions are such that both can be used. Although some progress has been made on this problem, the methods still only give an estimate of the true resistivity. Both are based to some degree on the assumptions of uniform and horizontal beds which are seldom, if ever, encountered.

Furthermore, some of the factors involved (such as degree of invasion) are often difficult to determine. This limitation is minimized to some extent by the experience that an interpreter may have in the area under study.

Fig. 1 shows that the well penetrates an apparently thick uniform bed. Drill-stem tests showed that the same formation becomes a water sand at a depth of about 7,200 ft.

It is quite rare to encounter an electric log that clearly defines the oil-water contact. Also, such conditions simplify the determination of R_o has to be determined from self-potential and resistivity measurements made with contact logging devices (Micro-Log, contact log, micropetrograph). A subsequent problem will illustrate such an application.

Where data for the determination of R_o are not available in the well of interest the data from a nearby well may be used or R_o read from the log of an edge well drilled through the water sand. Sometimes R_o can be read from a water sand lying above or below the formation of interest if the sand characteristics and water composition (and salinity) are believed to be about the same.

In Fig. 2 the resistivity curve of Fig. 1 is drawn using a large scale and related with comparable capillary pressure and relative permeability curves. This points out the possibility of developing capillary-pressure curves from electrical-survey data and should clarify, to some extent, the relationships among the respective types of data.

Determination of interstitial-water saturation from electrical survey data has been widely accepted. In many wells electrical surveys are made as a routine exploration practice and thus are available for use in water saturation determination. Furthermore, this method has the advantage that a fairly large sample of in-place rock is involved. Other methods (Part 25 and Part 26 of this series) involve tests on many small samples of the formation. Of course the use of cores cut with oil-base mud is considered the most reliable method of determining interstitial-water saturation. However, it is often not economically practical, but may be used on a limited scale to determine the proper selection of electrical surveys and/or their reliability.

Acknowledgment

The authors acknowledge assistance of E. A. Finklea, Schlumberger Well Surveying Corp., in the preparation of this paper.

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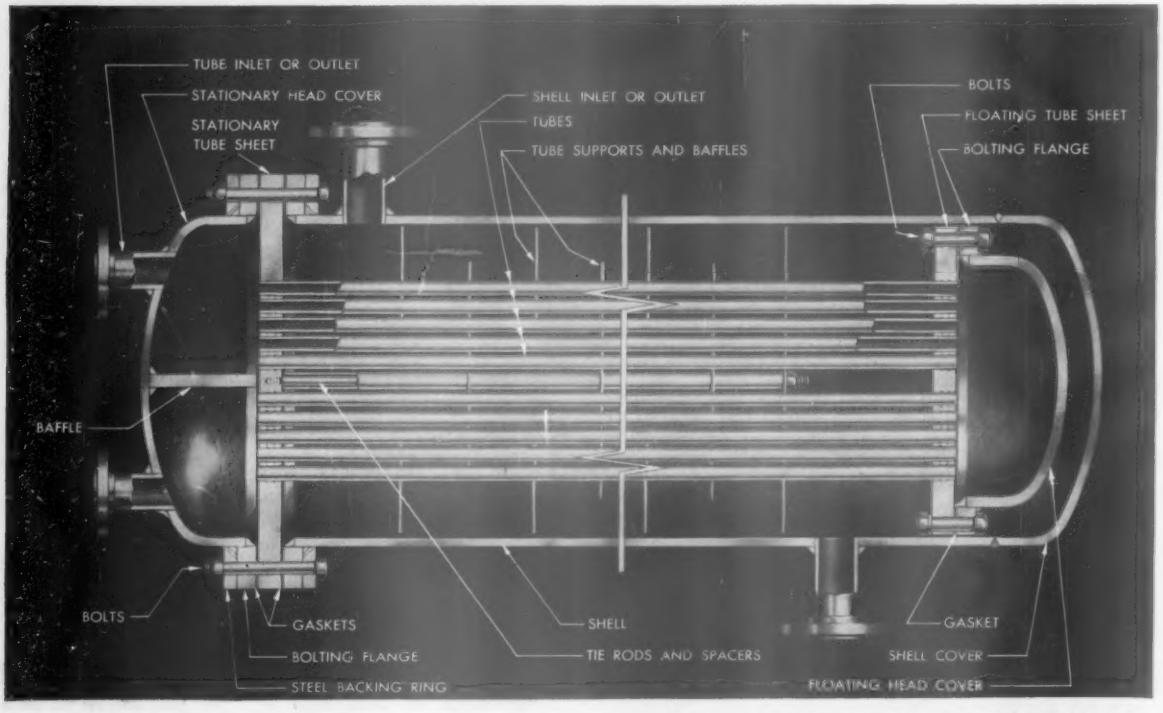
ALCOA is conducting a series of engineering conferences on process industries applications of aluminum during 1960 in a number of major cities. Contact your nearest ALCOA sales office for full particulars and dates.



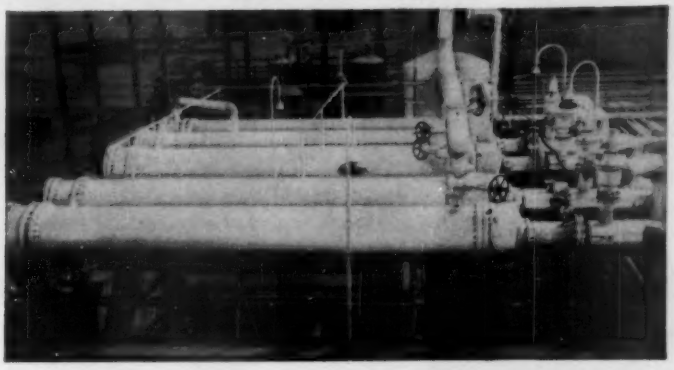
For certain processes where corrosive or sensitive materials are involved, it is often advisable to use aluminum for entire heat exchanger systems to avoid system corrosion and contamination of the product. A typical all-aluminum heat exchanger is shown here. Alloy recommendations are given in the table opposite.

Alcoa Aluminum Tubing protects color in the world's largest rotary steam-tube drier. The drier measures 10 ft in diameter by 100 ft long.

A Midwest utility saved 50 per cent on tubing costs by using Alcoa Aluminum instead of admiralty for tubing in this surface condenser. Successful operation of this unit has led to the installation of similar units by other utilities. This use demonstrates aluminum's economy and superior resistance to ammonia, carbon dioxide and hydrogen sulfide.

A battery of all-aluminum heat exchangers in a polyethylene plant. Selected for initial low cost, these aluminum exchangers provide freedom from product contamination as well as desirable low temperature properties.

Construction of a heat exchanger utilizing Alcoa Aluminum Tube. Superior working properties plus the cold-drawing method by which Alcoa seamless heat exchanger tubes are produced results in close dimensional tolerances and smooth inside and outside surfaces.



This all-aluminum dephlegmator in a large coke plant is used for the regeneration of ammonia liquor in a hydrogen sulfide scrubbing operation. Aluminum tubes lasted five times longer than steel tubes in a similar use.

Alloy Recommendations for Aluminum Heat Exchanger Construction

	Alcoa Designation	ASTM Specification*	Alloy
Tubes	3003-H14	B234	M1A
Alclad (inside)	3003-H14	B234	clad M1A
Alclad (outside)	3003-H14		clad M1A
Alclad (both sides)	3003-H14		clad M1A
	6061-T6	B234	GS11A
	6062-T6	B234	GS11C
Tube Sheets	3004-H112	B178	MG11A
Alclad	3004-H112	B178	clad MG11A
	6061-T6	B178	GS11A
Alclad	6061-T6	B178	clad GS11A
Baffles	3003-H14	B178	M1A
Alclad	3003-H14	B178	clad M1A
Tie Rods	6061-T6	B273	GS11A
Shells & Headers	3003-H112	B178	M1A
Alclad	3003-H112	B178	clad M1A
	3004-H112	B178	MG11A
	5052-H112	B178	GR20A
	5154-H112	B178	GR40A
Fittings	3003-F	B274	M1A as applicable
	6061-T6	B274	GS11A as applicable
Flanges	6061-T6	B247	GS11A as applicable

*Only the basic number is shown since Alcoa products are manufactured to the latest issue of the specification. The complete number would indicate the year of issue.

Aluminum Company of America, 865-J Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for product transfer and other uses in the process industries:

- ☐ 10197 Aluminum Pipe and Fittings
- ☐ 10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ 10270 Alcoa Utilitube
- ☐ 20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 10460 Process Industries Applications of Alcoa Aluminum
- ☐ 11453 Solving Refinery Corrosion Problems with Aluminum
- ☐ 20437 Aluminum Alloy Heat Exchangers in the Process Industries
- ☐ 19416 Brazing Alcoa Aluminum
- ☐ 10415 Welding Alcoa Aluminum
- ☐ 19051 Alcoa Aluminum Handbook

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BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Questions on TECHNOLOGY

World tanker fleet in 1965

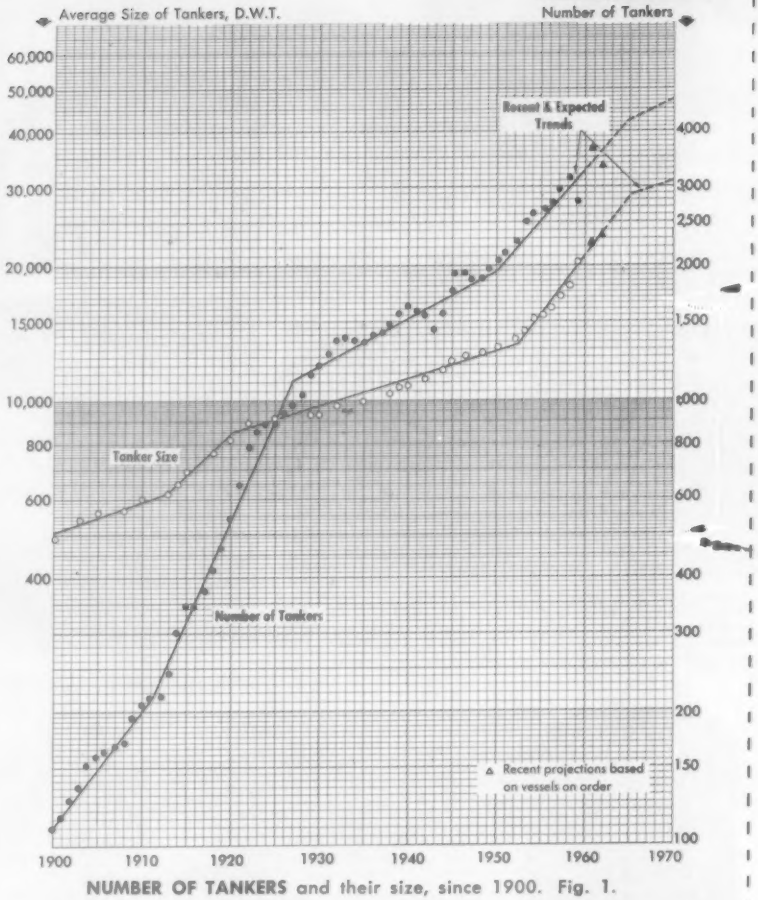
The news is full of stories about larger faster oil tankers. How many of our tankers are of the new larger types? S. Wm. T.

Precise information about the exact sizes of the newer vessels is available in the latest yearly report of The Oil and Gas Journal (Kahle, L. F., Tanker Surplus Keeps Growing, Dec. 28, 1959). Another report will be published in the International Issue during December 1960. Although the large new ships are vitally important from a competitive standpoint, they constitute only a small proportion of the total fleet. As of October 1, 1959, the percentages of various sizes of vessels were:

Dw. tons	Per cent
6,000-16,000	26.63
16,001-20,000	42.86
20,001-30,000	15.30
30,001-40,000	11.60
40,001-50,000	2.92
50,001-60,000	.22
60,001-70,000	.14
70,001-80,000	.04
Over 80,000	.29

The average vessel had a size of 20,285 dw. tons.

Fig. 1 shows the trend in world tanker fleets since 1900. During 1913-1920 a large increase in tanker size occurred because of the mass production of the 16,600-ton T-2 tanker. This excellent vessel (until recently) has dominated the composition of the world fleet. Another great increase in tanker size became useful in about 1951, when it became apparent that much of the world as well as the North American Continent would be using large amounts of petroleum which would be delivered from distant points. The present trend toward larger tankers is expected to continue until about 1965.



NUMBER OF TANKERS and their size, since 1900. Fig. 1.

The rate of increase in size and in number of tankers is clearly evident in the following tabulation:

	Smoothed avg. size, Dw. tons	Increase* per year, Dw. tons	Speeds, knots	Increase* per year, knots
1900	5,000		9.7	
1910	5,900	90	10.4	0.07
1913	6,100	67	10.5	0.03
1920	8,500	340	11.7	0.17
1930	9,600	110	12.2	0.05
1940	11,100	150	12.8	0.06
1950	12,800	170	13.3	0.05
1952	13,100	150	13.4	0.05
1960	21,000	990	15.1	0.21
1965 est.	28,500	1,500	16.3	0.24
1970 est.	31,000	500	16.6	0.06

*These are for the proceeding period of years, i.e. for the first number, the years 1900-1910.

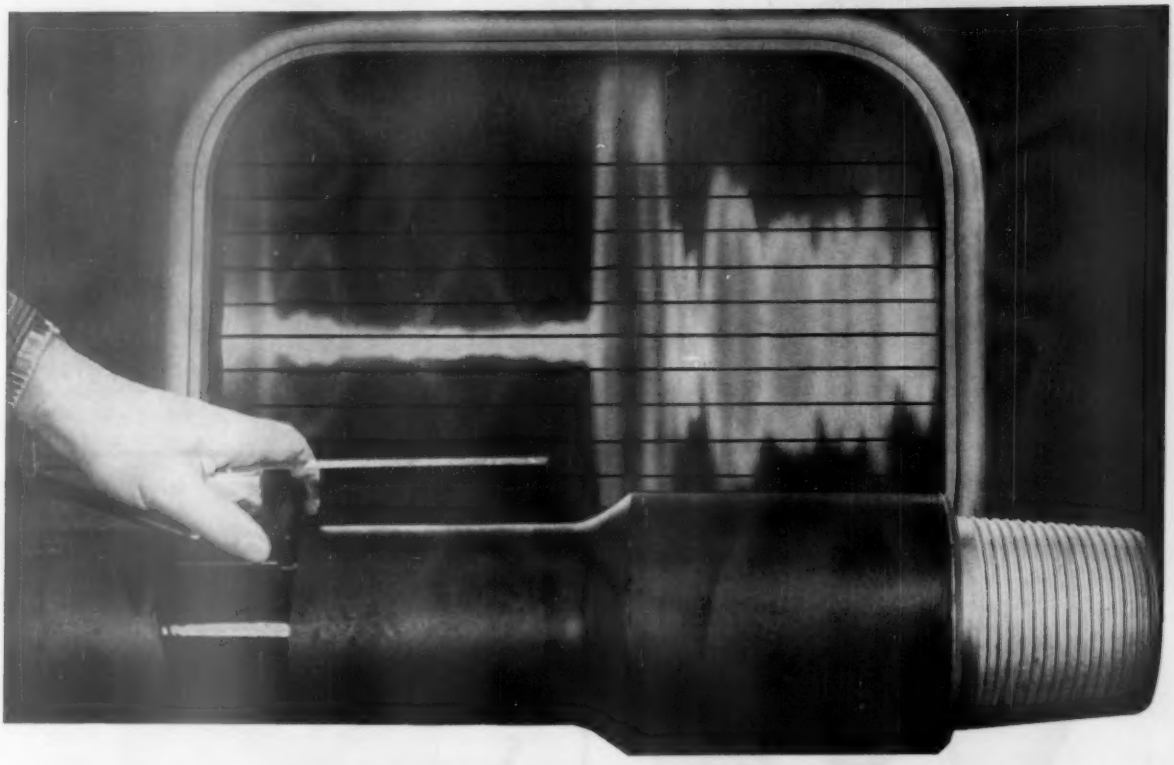
Ranges of operating costs

In your Process Costimating issue of September 14, 1959, p. 93, the direct operating costs of Table 1 do not add to the 24-37 cents shown as the total. R. E. G.

There is no reason to sum all of the smallest operating costs or to sum all of the largest ones. No general rules can be given to indicate which of the highest costs should be summed with the lowest costs. However, the highest maintenance costs are frequently associated with the lowest utility costs. Likewise, maximum royalty costs are usually associated with the lowest cost extremes of most of the other items (i.e. for small independent refiners) whereas large refiners whose costs on most items are usually the upper extremes may pay no royalty whatsoever.

None of these difficulties arise when costs for a particular operation are considered because the cost extremes then naturally associate themselves properly.

How an electronic signal



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If any inclusions or defects are present the return signal will be shown on the screen. The joint is then removed and another joint is welded on.

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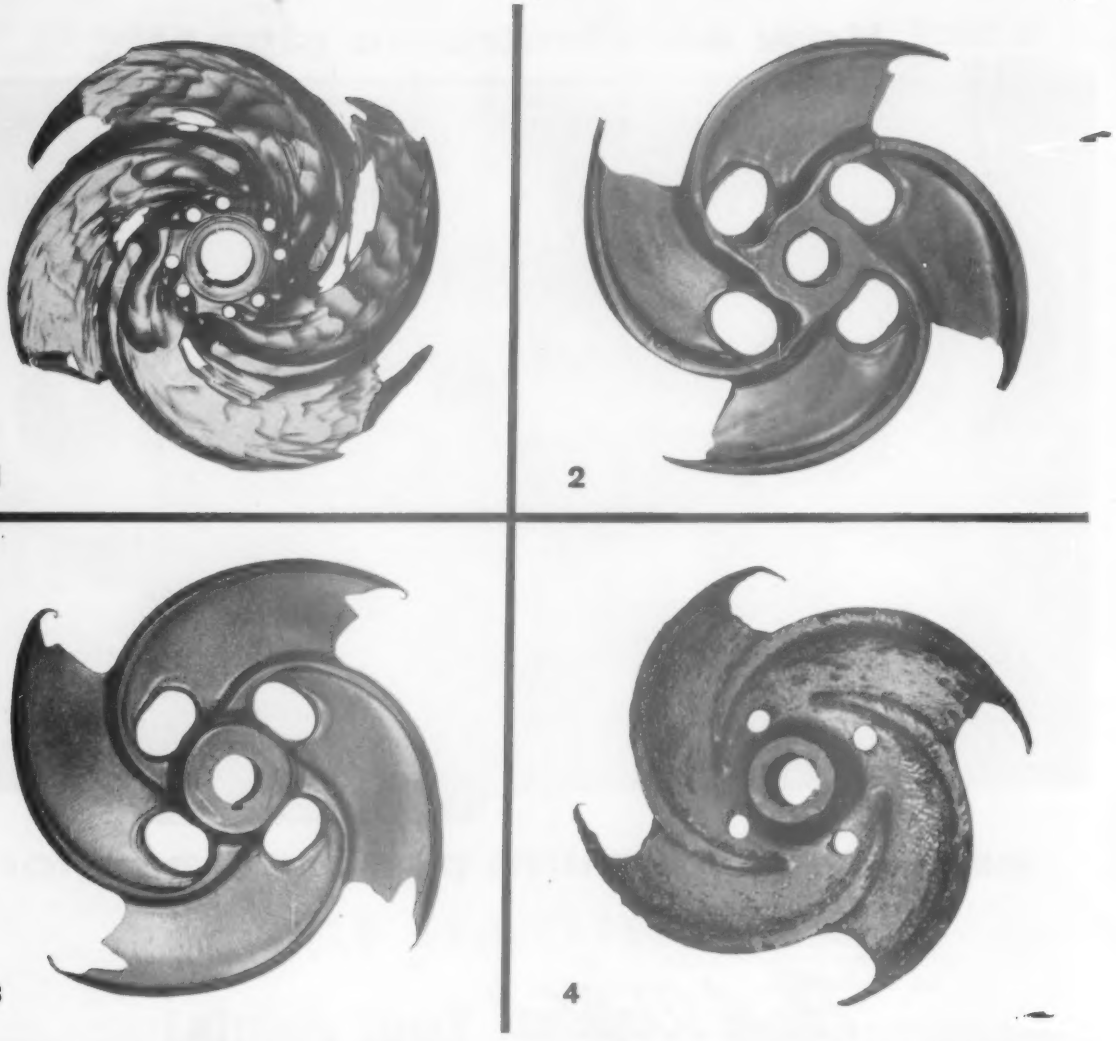

HOW GOOD A PUMP DETECTIVE ARE YOU?

Each impeller above is made of Worthite, an austenitic chromium-nickel-molybdenum stainless steel. Each was selected for its corrosion and abrasive resistance to the fluid being pumped. Each was in a pump correctly selected for the hydraulic problem to be faced. But each wore out long before necessary. Can you tell why by looking at the impellers?

In figure No. 1, the impeller handled lime mud in a paper mill. The deep gouges are caused by large chunks of lime. The feathered edges are caused by churning in the mud at start-up and when the suction tank was almost empty. Agitation of the liquid in the suction tank and by-passing solved the problem.

In figure No. 2, the Worthite impeller handled 65% potash slurry from the bottom of a thickener. It lasted 3 months. The percentage of solids was too high and the pump was operating at too high a capacity. By operating nearer the maximum efficiency and with a slight reduction in solids, the life of the impeller was more than doubled.

In figure No. 3, the impeller handled fine (48 mesh) potash slurry with some sharp sand. The pump flow was controlled by throttling the suction. By eliminating throttling of suction and installing a by-pass, impeller life was increased from one to about four years.

In figure No. 4, the pump delivered 50% by weight slurry to a plate and frame filter press. As the filter filled up, the pump operated back toward shut-off, causing wear on the outer third of the impeller vanes. The solution was to shut the pump down when adequate filter cake had been built up, but before the pump began to operate against shut-off. Impeller life increased three times.

Now, why did the impellers wear out long before necessary? It wasn't impeller material or pump selection. It *was* the system on which the pump was used. Seemingly small factors in installation or operation prevented achieving the full economy promised by Worthite in handling corrosive-abrasive fluids.

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WORTHINGTON

Only a few years back, a group of men declared that a quality test was needed for asphalt. This conclusion was voiced with such authority that both asphalt producers and consumers hastened to agree. There was plenty of action, and asphalt technologists are still puffing with the effort to keep up with that elusive factor called quality. Here are some of the directions their efforts are taking, as . . .

Asphalt producers keep looking for standard quality factor

BY DUANE W. GAGLE
Asphalt Engineer,
Phillips Petroleum Co.,
Bartlesville, Okla.

SOME OF OUR asphalt specifications are encrusted with the moss of ancient times. As a matter of fact, some specifications now in use are identical to those required when hand-sledged rock bases were a standard construction item.

One thing is evident: Asphalt users were able to do some very good jobs in spite of the specifications. As specifications now stand, they reflect long and studied efforts on the part of many people to orient their limits into a language that will tell the real story of how highways will perform, using the old tests as the working tools.

Much of the effort has been frustrating. As a result, both producers and consumers have been nursing a healthy dissatisfaction with the smug empirical methods used to define the properties of asphalt. There is a "housecleaning" air about the whole matter and some interesting proposals are developing.

Truly what we are seeking is a better way to predict what asphalt will do in service. This will help establish better methods and controls to govern asphalt use.

Thin film test. The hardening or drop in penetration of asphalt while it is churning around in the mix-plant pug mill has been a matter of concern for years.

The Bureau of Public Roads sought to control the hardening effect and ultimately developed the thin-film-oven test. By this means asphalts having excessively volatile constituents can be detected. The test also has a polymerizing or condensing effect on practically all asphalts. Taking this into account, experimental limits were established.

The thin-film test is not made on a film such as would be found in mix-plant coating operations or the films bonding the mix when placed. It is actually a more severe version of the regular loss-on-heating test. A layer of asphalt ⅛-in. thick in a 5½-in.-diameter tray is heated for 5 hours at 325° F. on a revolving shelf in an oven. Per cent penetration retained as compared to the original, loss in weight, and ductility are then determined.

TABLE 1—PACIFIC COAST STATES' THIN-FILM-OVEN TEST SPECIFICATIONS

	Grade			
Thin-film-oven test	60-70	85-100	120-150	200-300
Loss in weight, max.	0.80	0.85	1.00	1.50
Penetration at 77° F. % of original, minutes	50	47	44	40
Ductility at 77° F. cm., minutes	50	75	75	75

At least 10 states have adopted the thin-film test. Pacific Coast states were the first to make the change. Limits set for the Pacific Coast are shown in Table 1. Based on Asphalt Institute and Bureau of Public Roads Surveys, the Institute feels that the per cent of retained penetration limits for asphalts representative of the country as a whole should be slightly less than those adopted by the West Coast. It's recommendations are:

Grade	Penetration at 77° F., % of original, minutes
60-70	50
85-100	45
120-150	42
200-300	37

Limits for loss and ductility of the thin-film-test residue have not been adopted by the Asphalt Institute. Many technologists concede that the per cent of penetration retained supplies the most useful information as far as correlation with service behavior is concerned.

The thin-film test will undoubtedly correlate with performance behavior if proper field controls are exercised. Careful control of asphalt temperature to obtain the optimum viscosity for proper coating, mixing time, and asphalt content are of equal importance. In all phases of any operation, conditions must be known and controlled. Since all variables cannot be eliminated, the only alternative is to try and understand them.

Before long the thin-film-oven test probably will be incorporated into practically all paving asphalt specifications. If this test is adopted, the regular loss on heating test should be excluded from specifications.

Viscosity. The most refreshing development is the wide-spread determination to measure viscosity in fundamental units.

Investigation is under way using the Shell microviscometer. The Shell instrument is particularly useful for consistency measurements at low temperatures which are outside the range of standard methods. Age hardening and durability studies can be made by the Shell sliding-plate instrument. As more people become familiar with its scope of application, it will branch out from the research area to the field of practical control.

Liquid-asphalt consistency measurement is undergoing an interesting facelifting. Kinematic viscosity studies using the Zeitfuchs crossarm viscometer, ASTM D-445 Appendix F, have conclusively demonstrated that it is practical to run the entire range of liquid grades at a single temperature, 140° F.

Compare the Saybolt viscosity specifications now in use with the corresponding kinematic limits at 140° F. In this way you can see how the man in the field can better understand the

transitional consistencies between the various grades (Table 2).

The kinematic crossarm viscometer is more accurate, requires less sample, and saves operator's time because it is so much faster to run than the Saybolt Furol method. Kansas was the first state to officially adopt alternate kinematic viscosity limits at 140° F. for liquid grades. Pacific Coast states and the Asphalt Institute both favorably view the kinematic method at the single temperature of 140° F. As the benefits become more generally known, we can reasonably expect a general adoption of kinematic limits.

Now for a word about viscosity in the "quality" sense. In order to properly coat mineral aggregates for hot-mix construction, asphalt should have a Saybolt Furol viscosity between 74 and 150 seconds. This appears to be a fairly wide range. West Coast states have placed minimum and maximum limits on a viscosity at 275° F. for the various grades of asphalt. By so doing, the temperature-viscosity relation suited for mix-plant operations is kept in line.

In the Middle West, some states are taking a much more critical view of the temperature-viscosity relationship for mix design and plant operation. They require a temperature-viscosity curve for the particular asphalt cement grade. In this way they can select narrow temperature limits and thus obtain the viscosity that will best coat the aggregate.

Supplying the temperature-viscosity curve has not created any particular problem where it has been required. In fact, many Middle West people prefer this method to that of incorporating a fixed viscosity range in the specifications.

In the spray-bar application of liquid grades, the asphalt should be used at a temperature that will give a Saybolt Furol viscosity between 25 and 100 seconds. Engineering instructions usually indicate that dense surfaces will require the lower range of viscosity and the open surfaces the higher part of the viscosity range. Among other things, a careful selection of the right consistency for the surface condition is necessary for a good seal coat.

Temperature - viscosity curves are good working tools in this case. Operators should be instructed in their use. The temperature-viscosity curve will more than likely start to appear in the future asphalt cement and cutback specifications.

TABLE 2—COMPARISON OF SAYBOLT FUROL AND KINEMATIC VISCOSITIES

Grade	Seconds	Saybolt Furol temperature, °F.	Kinematic centistokes at 140° F.
0	75-150	77	30-50
1	75-150	122	95-180
2	100-200	140	200-400
3	250-500	140	500-1,000
4	125-250	180	1,000-2,400
5	300-600	180	3,000-7,000

Penetration ratio. Some areas, mainly the Pacific Coast, are sampling the effectiveness of the penetration ratio test. To arrive at the magic number, the penetration at 39.2° F., 200 g. loading, 60 seconds time, is divided by the penetration at 77° F., 100 g. loading, 5 seconds time and multiplied by 100.

The resultant figure is a ratio that theoretically can tell whether one asphalt can endure cold better than another. Perhaps it can forecast healing tendencies or supply information on temperature susceptibility in the temperature ranges encountered in service.

The intent of the test is commendable. However, the test method and the variations introduced would drive a statistician mad. The penetration test itself is under fire as being a relatively unscientific type of measurement. Then to introduce different temperatures, different loadings, and different time intervals carries the test a long way from its original intent.

Another complication is that, by mild oxidation, many low-penetration-ratio asphalts will increase this magic number to a radical degree. Will this translate to the road by virtue of oxidation encountered in the mix plant, or will the penetration ratio gradually increase with age through the slow process of weathering?

The latest Bureau of Public Roads survey of asphalt cements indicates that penetration ratio varies too widely to be incorporated into a nationwide specification. On the other hand, strong local feeling may generate data that can convince unbelievers of its value.

Flash point. Aside from safety considerations, flash point is a quick indication of asphalt volatility. During the past 10 years or so, introduction of surface - active agents to control foaming encountered in loading and field handling has had a tendency to foul up the flash point as measured by the Cleveland Open Cup apparatus. Antifoaming materials such as silicones tend to subdue the foaming or vaporizing tendency of the asphalt sample and the flash point is considerably higher than without antifoam agent. To counteract this effect, the Pensky-Martens flash test was substituted. The Pensky-Martens equipment has a stirring paddle and an enclosed vapor space. It has satisfactorily solved the problem, but only at the expense of a more difficult apparatus to clean and decoke.

A recent survey shows that the use of antifoam agents is quite general and has no apparent influence on the behavior of the asphalt in service. Such being the case, the Cleveland Open Cut can stage a comeback which should be a pleasant development for the people who run the flash tests. Here is the way it can be done.

Antifoam agents up to 0.2 p.p.m. are as effective in foam control as much higher concentrations. Therefore the Cleveland Open Cup test can be standardized by adding 0.2 p.p.m. of a stipulated antifoam agent to the test sample. The flash test minimum can then be raised to conform to the level of the treated sample. This would be much easier speculating about the

Next Week:

What the Drilling Industry Should Know

THE JOURNAL'S Annual Drilling Issue of September 26 runs the gamut—from drilling equipment to formation data on more than 100 fields now under development.

One of the highlights will be a 16-page report on the selection and operation of drilling engines, based on the latest information from leading manufacturers, drilling contractors, and oil operators.

Statistical information on more than 100 active drilling areas in the U. S. and Canada includes a field-by-field description of such important items as costs, drilling conditions, formations, and field practices.

Also, watch for the interesting results of the Journal's 1960 census of drilling contractors—how many there are, where they're located, how many rigs they own, and other relevant material.

influence of antifoam agent on the sample.

Distillation. The ASTM D-402 distillation test for cutback asphalts is a target for modification or change. The stubby short-necked flack does not permit a reflux condition that will give consistent answers. Usually this is due to the varying foam level which occurs during the progress of the distillation, influence to a considerable extent by the inherent foaming tendency of the oil.

Again we have a condition that belongs to the test and not to the performance of the oil in the road. Rather than go to vacuum methods and their attendant problems, standardize the existing test to give more consistent results. Some state and industry people have found that a drop of the surface-active antifoam (0.2 p.p.m., is ample) will permit the distillation to proceed in a clean, orderly manner with repeatable and reproducible results.

If a standard antifoam agent in a stipulated concentration were incorporated as part of the test, limits could be established for a penetration of residue, without the question of whether or not an antifoam agent was used.

Curing index. It has also been established that the curing index for RC cutbacks can be improved by use of a surface-active agent. There are reliable test data to show this to be the case. Since antifoam materials do not seem to affect the behavior of asphalt in the road, we can only conclude that the antifoam agent is a test improver, not a field-service improver.

Here again the use of an antifoam product is needed as a requirement for accurately determining the curing index. Thus by standardization with the antifoam, limits could be applied that would better reflect the highway service experience.

The use of the surface-active agents is so general by both producers and users of asphalt that to exclude them would create numerous problems. It is best to incorporate them into our thinking when considering future test methods and limits.

A beneficial step has been taken to reduce the number of grades of asphalt cements. The Asphalt Institute has recommended the following grades as covering all paving needs: Based on penetration values they are 40-50, 60-70, 85-100, 120-150, and 200-300. The acceptance of this recommendation has been excellent. Next, a reduction in the liquid grades can be expected.

What can we expect in the way of better tests to define the engineering properties of asphalt? West Coast producers and consumers have a good-looking set of requirements that they consider adequate for paving asphalts.

Alternate Specification for Paving Grades Based on Viscosity:

1. Viscosity at 275° F. (mixing range).
2. Viscosity at 140° F. (high-temperature service).
3. Viscosity at 39° F., low shear rate (low-temperature service).
4. Viscosity at 39° F., high shear rate (low-temperature service).
5. Aging index:

$$\frac{\text{Viscosity after aging}}{\text{Original viscosity}} \text{ (durability).}$$

6. Shear susceptibility at 77° F., slope on log-log plot (rheological characteristics).
7. Flash point (safety).
8. Solubility (purity).

(All measurements to be made in absolute units.)

Although there is a long way to go in the development of equipment and instruments for the above-recommended viscosities, it shows that there is real hope of catching the elusive "quality" by means of tests that can be honestly translated into field performance.

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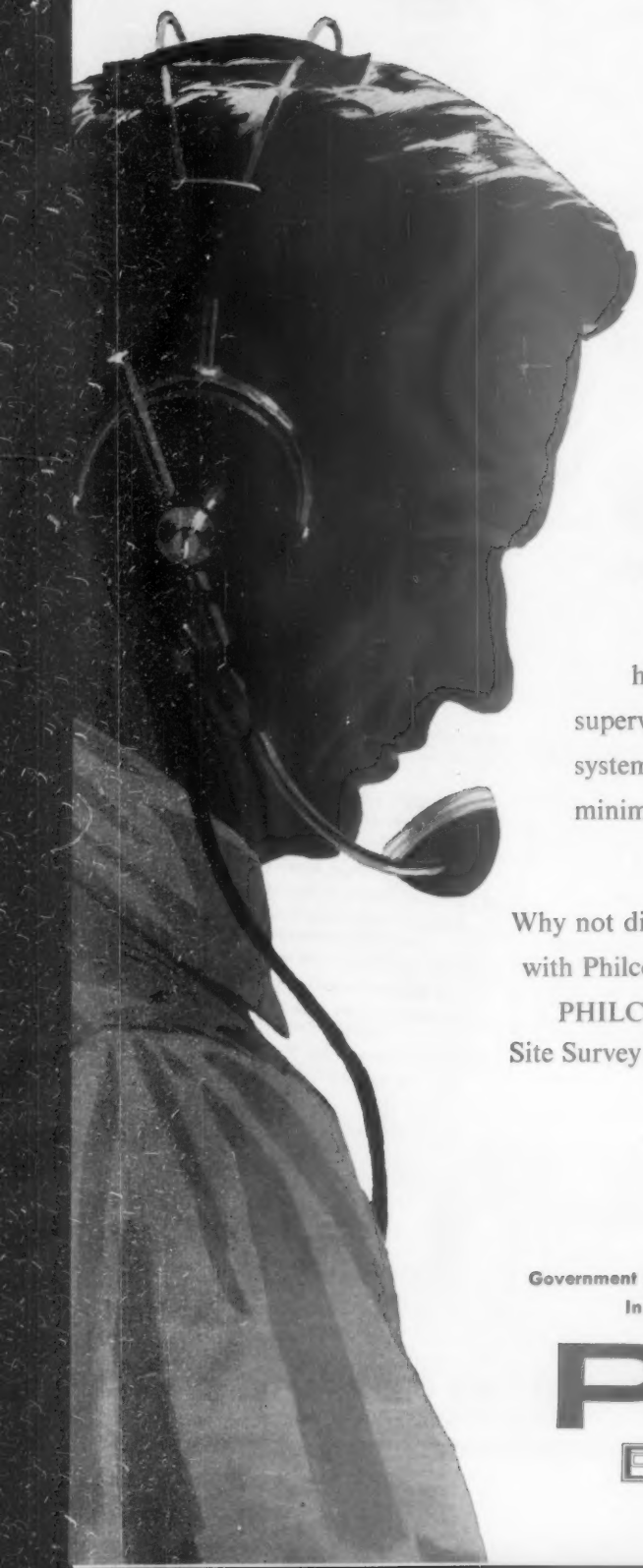

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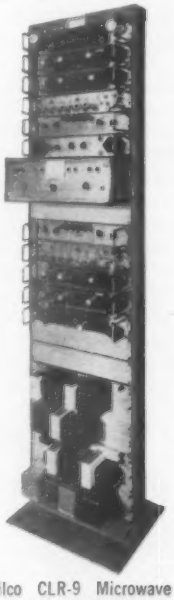

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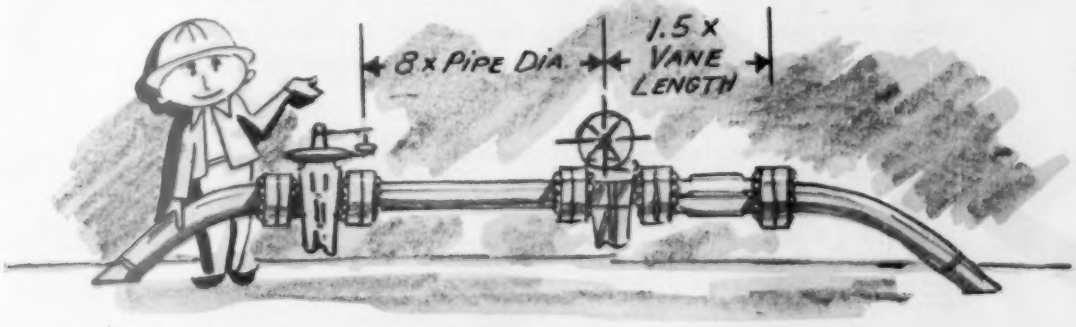
Cut turbulence and reduce noise

"...Headers are buried to decrease the intensity of sound."

SINCE the natural-gas industry is faced with the problem of transmitting larger volumes at higher pressures—conditions which increase noise levels—more and more attention must be paid to noise abatement.

Larger volumes and higher pressures mean greater turbulence, the major cause of noise at meter and regulator stations. Two of the responsible factors, pipe diameter and velocity, can be controlled within economical limits.

It has been found that, if maximum velocities of 85 ft. per second are maintained, the noise level is reduced. Therefore if station piping, headers, regulator runs, etc., are sized for a



"...The upstream spool was eight diameters in length, the downstream spool one and one-half times the length of vanes."

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maximum velocity of 85 ft. per second during the peak hour, velocity will be considerably less during periods of average load, and the noise level will be reduced. Designing for velocities much below this is economically impractical.

Station layout. Other factors which affect turbulence and thereby increase the noise level concern the physical arrangement of the station. The general station layout is designed as simply as possible, containing the least number and length of headers, runs, etc., thereby reducing the area available for the radiation of sound.

Some factors governing plant layout, as described by W. F. Kienast, Houston Gas and Oil Corp., follow. Kienast listed them in a paper for the ASME Petroleum Division meeting in New Orleans Sept. 19-21.

Headers are buried to decrease the intensity of the sound. They are designed so that no dead areas exist. By burying the headers, the inlet header becomes an extension of the inlet line itself. Regulator runs take off from this header at 45° with a 45° ell aboveground. These runs enter the intermediate header in the same manner and, continuing through the meter tube, the discharge or outlet header then becomes an extension of the downstream line.

This arrangement has a maximum bend of 45° aboveground and results in only two changes per run. This helps since each change of direction or impingement point is a source of turbulence.

Sweep laterals. Use of welding tees at junction points causes the gas to impinge upon the opposite wall. This is where the highest intensity of sound occurs. Use of a sweep lateral, a 60° ell with a long tangent on one end, causes the gas to change direction or turn 60° previous to entering the header, thus reducing the angle of impingement from 90° to 30°. This fitting reduces the noise level to approximately half that produced when using a welding tee.

The three-radius, 60° ell also reduces the force with which gas enters the header. Such an ell can be produced at no higher cost than a standard ell and can be welded into the header with a final cost less than that of a welding tee.

Plug valves are in common use in meter and regulator stations. When bolted to or near the regulator, this type valve increases the gas velocity in the regulator and in flutter to the regulator internals. The velocity profile nears normal about eight pipe diameters downstream. The noise level can be reduced by moving the upstream regulator upstream by about this distance.

Regulator a factor. The type of regulator has a considerable effect on the volume of noise. Those with large body areas downstream of the valve seat and those with piston-type valves indicate a definite improvement over other types.

Since the regulator is the main source of vibration, regulator spools were considered. They were made as short as possible. The upstream spool was approximately eight diameters in length because of the plug valve location. The downstream spool was long enough to accommodate straightening vanes, 1.5 times the length of metering vanes. Pipe used in the spools had a wall thickness of ½ inch. These steps accounted for a small improvement in noise abatement.

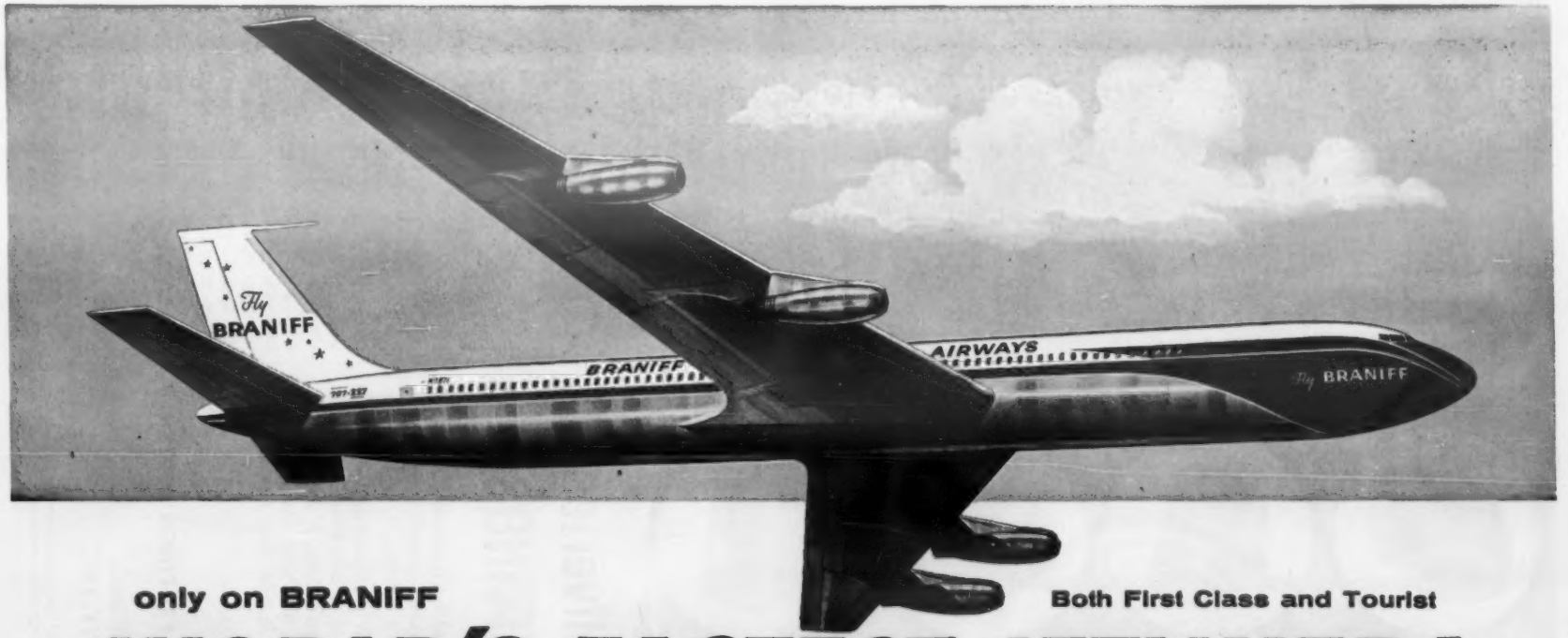
Aboveground piping or appurtenances, such as the relief-valve vent pipe, were found to be noise makers. Heavy bracing from opposite sides brought some relief.

Actually very little can be done in station design other than to control those areas which add to turbulence of the gas stream. If noise continues at a disagreeable level, an acoustic filter immediately downstream of the regulators can be very helpful. Further treatment means sound-absorbing materials or isolation of buildings, both of which are beyond consideration.

Chart integrator computes average temperature, gravity

A MAJOR gas pipeline company finds a chart integrator useful in computing average temperature and specific gravity. As a general rule, temperature and specific-gravity charts used in gas measurement are reasonably constant so they may be sight-read with sufficient accuracy to obtain the average temperature or specific gravity to be used for orifice-meter computations. However, temperature and specific-gravity charts located close downstream to a dehydration or hydrocarbon-recovery unit are too erratic to

Excerpted from paper presented at recent meeting of American Gas Association.



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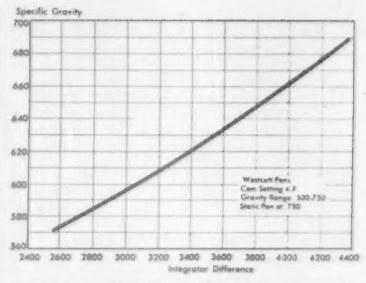
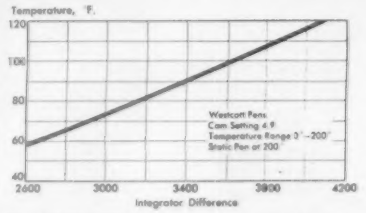


AVERAGE SPECIFIC GRAVITY may be obtained from integrator difference by using previously prepared curve. Fig. 1.



AVERAGE TEMPERATURE may also be obtained from integrator difference. Fig. 2.

be sight-read with any real accuracy.

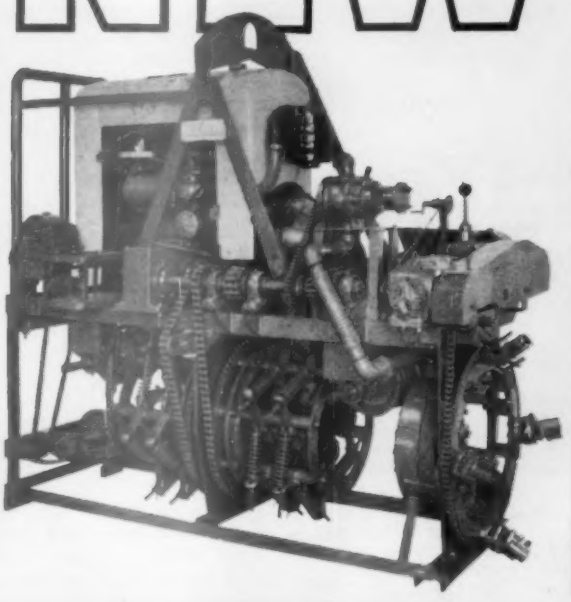
The average recording may be obtained by averaging the readings for each 15-minute period during the 24-hour day. This is usually laborious, however. Equally good results can be obtained much more quickly by integrating the troublesome chart in sequence with the corresponding orifice-meter charts. The integrator difference thus obtained may be referred to a previously arranged curve (see Fig. 1 and Fig. 2) and the average temperature or specific gravity quickly obtained.

In integrating a single-line chart, the chart recording may be traced with the differential pen of the integrator; the static pen of the integrator may trace any convenient circle, the only requirement being that the same circle be consistently used. To obtain the graph, a series of circles are run on the specimen chart and the integrator differences for these circles are obtained.

These differences are then plotted using the integrator differences as the abscissa and the corresponding specific gravity (or temperature) as the ordinate. A curve is then drawn through these plotted points. When the specific gravity or temperature is integrated, the average specific gravity or temperature is determined by applying the integrator difference to the graph.

Using this method, the difficult specific-gravity or temperature charts can easily be averaged in 30 to 40 seconds. This method works equally well if it is desired to obtain the average pressure from a chart.

NEW



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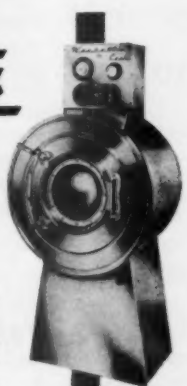

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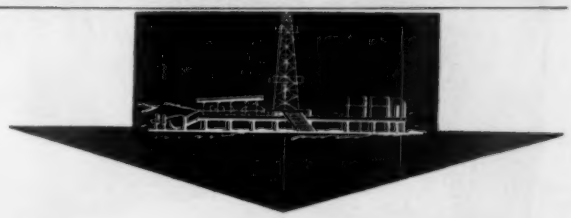

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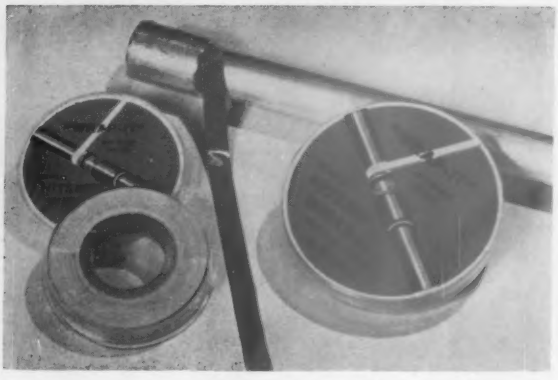
Teflon tape to seal threads



. . . on pipe joints and threaded cable connectors eliminates the need for conventional pastes and compounds to seal pipe joints in hydraulic, compressed air, vacuum, steam, and corrosive chemical lines, according to the maker.

To seal a joint, just wrap the tape around the pipe threads. You can use the tape on such materials as steel, iron, brass, plastic, aluminum, monel, and synthetic rubber, the maker says. The Wrap-it tape comes in a ½-in. width, in 10 colors, and in 25, 50, and 75-yard lengths for temperatures from —250° to 500° F. Source: **Hi-temp Wires, Inc., 1200 Shames Dr., Westbury, N. Y.**

Recorder handles 400 points

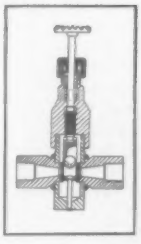
. . . and displays them on one chart, according to the maker. Consequently, it offers a way to reduce instrument panels ranging in length up to 100 ft. to a size so that one supervisor can watch from one spot all aspects of a process operation.

The K-logger makes from 10 to 400 analog recordings, at rates up to 10 points per second, in 4 by 6-in. chart frames printed in columns and rows on one large sheet of paper. Each frame has an independent calibration. Both pneumatic and electric signals, including thermocouples, can be mixed on one recorder, the maker says.

The large chart, up to 4 by 6 ft., is held against a translucent platen, or printing surface. Fluorescent lights behind the platen give a soft illumination that penetrates the paper. Transparent-process symbols applied to the platen show through the chart to form a graphic panel with full color-coding. Source: **Keinath Instrument Co., Columbus, Ohio.**

●

Valve



. . . converts easily from a manual valve to a control valve or a motor-operated on-off valve, according to the maker. The P-K Paul barstock valve is designed so conversion is made simply by replacing the bonnet and stem of the manual valve with a new bonnet and stem and a yoke carrying the required top-works. The valve offers a way to reduce valve inventory and spare parts. It also makes a way to upgrade dead-end service valves and use them for critical temperature and pressure operations. You can obtain the valve in

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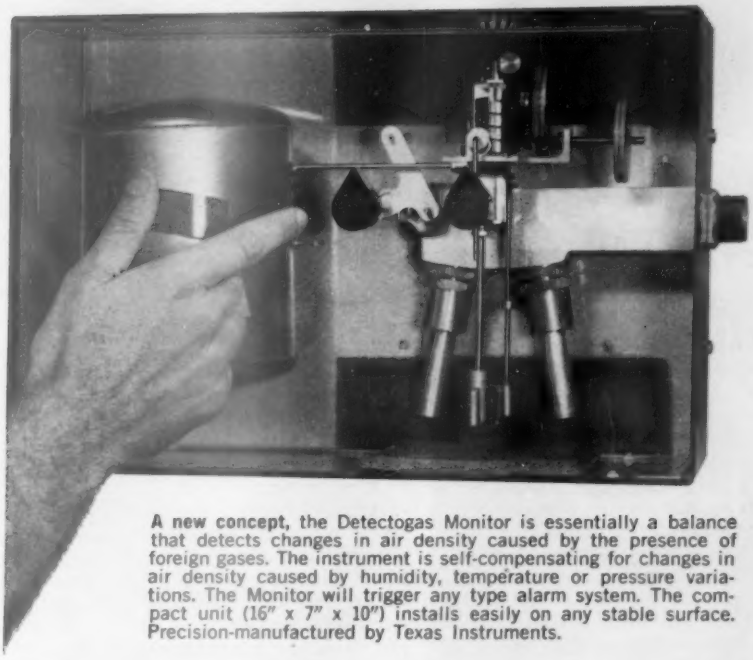
Now, the long-awaited answer to disastrous gas explosions



A new concept, the Detectogas Monitor is essentially a balance that detects changes in air density caused by the presence of foreign gases. The instrument is self-compensating for changes in air density caused by humidity, temperature or pressure variations. The Monitor will trigger any type alarm system. The compact unit (16" x 7" x 10") installs easily on any stable surface. Precision-manufactured by Texas Instruments.

Scarcely a day goes by without news of a gas explosion somewhere in the U.S. Insurance claims for property damage alone mount into the millions annually. This is to say nothing of personal injury and lost lives.

Now, after four years of research and exhaustive testing, a truly practical gas detection instrument has been developed that puts gas safety within the reach of all. The revolutionary Detectogas Monitor is less than one-third the cost of old-style detectors.

Low cost Detectogas Monitor operates continuously without power or manpower

Unlike any other gas detection device—and about ⅓ the cost — the Detectogas Unit monitors *continuously, without power* and *without attendant*. In normal, uncontaminated air a perfect balance is maintained (and stabilized against normal vibrations and air currents). But in the presence of lighter or heavier-than-air gases, the balance trips and triggers an explosion-proof switch. This can close any desired secondary circuit. Alarms can be sounded, valves shut off, exhaust fans started, phone calls placed —*automatically*.

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sizes from ½ to ¾ in. with pressure ratings of 1,500 and 2,500 psi. Source: **General Kinetics Corp., 197 S. Van Brunt, Englewood, N. J.**

●

Two-in. rope

. . . holds 50,000 lb., claims the maker of this Gladiator-brand twisted polyethylene rope. The rope comes in sizes from ⅛ to 2 in. and colors of black and yellow for easy identification. Reportedly, it is extremely lightweight, easy to control, rotproof, and weather-resistant. The rope both sheds water and floats. Source: **Berkley & Co., Spirit Lake, Iowa.**

Flat storage

. . . for maps, drawings is provided by a new flat drawer file just put on the market. Small, flat items may be stored to form an attractive display presentation when the drawers are pulled out.

A hinged paperweight on the front and a protecting hood on the back of the drawer prevent edges of paper from curling. Stops prevent the drawers from being pulled out, yet are easy to release. The five-drawer cabinets can be stacked to obtain any desired height. Source: **Lyon Metal Products, Inc., 1933 Montgomery, Aurora, Ill.**

Trailer-mounted work platform

. . . is available, built for tough road conditions. The maker says the mobile work platform can be rolled over the toughest terrain where overhead maintenance is a problem. Of one-piece construction, the platform is delivered ready for work, requiring no setup time, according to the maker. It is expected to prove suitable for a variety of overhead maintenance such as painting, lighting, cleaning, wiring, and reaching of piping. Source: **Atlas Industrial Corp., 849 39th, Brooklyn 32, N. Y.**

●

New metal-removal electrode

. . . Grade Q, has been developed recently for the Arcair process of metal removal. The need for the new electrode was brought about as higher current densities came into common use with electrode sizes of ½, ⅝, and ¾-in. An accompanying thermal

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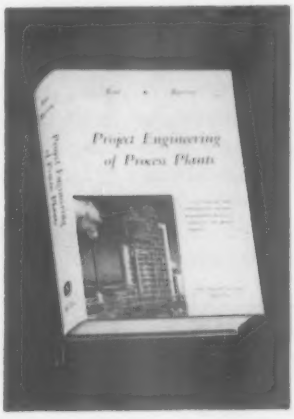

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shock can cause spalling and splintering off of electrodes made from other conventional material. The new Grade Q electrode eliminates this, according to the maker. Source: **Arcair Co., Box 431, Lancaster, Ohio.**

●

Microwave radio

. . . equipment is being produced to operate in the 11,000-to-15,000-mc. range. According to the maker, the MW-601 system will provide terminal circuits for lower-frequency systems entering congested areas and will open new frequencies for present licensees and others who do not presently have microwave-radio systems.

One innovation is a temperature-control chamber for the Klystron that uses no electrical power for temperature regulation. Instead, it automatically controls chamber temperature with a spring-operated mechanical device. Source: **Collins Radio Co., Box 1891, Dallas 21, Tex.**

●

Two-way radio

. . . base station recently developed fills, according to the maker, the need for higher-power base-station equipment for VHF-FM mobile radio systems. Providing 100 watts power output, the Model 6N100 base station consists of a sensitive receiver and efficient transmitter housed in a compact table-top console, the maker reports. In the event of power failure, the unit will operate from a conventional vehicle battery. Source: **Aerotron, Box 6527, Raleigh, N. C.**

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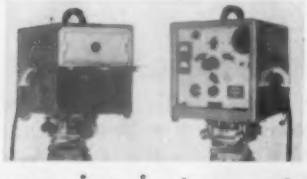


Surveying instrument

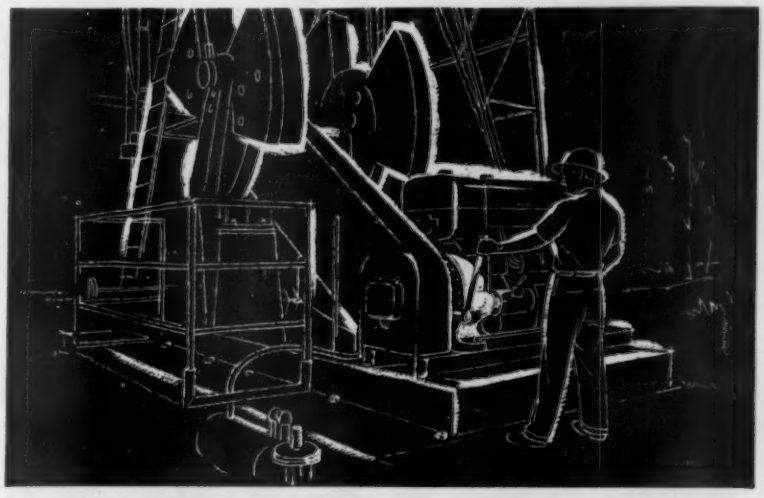
. . . just put on the market, an electronic distance - measuring instrument called the Geodimeter Model 4B, features a reading dial numbered to every 10 divisions, thus improving readability. Too, a new null meter and control instrument enable faster observations, the maker claims. A cell heater installed in the instrument permits operation at temperatures from —40° up to 120° F. The instrument weighs less than 30 lb. Operating range in bright sunlight is up to 5,000 ft. Source: **Geodimeter Co., Div. of AGA Corp. of America, 2013 Park Ave., S. Plainfield, N. J.**

●

Portable X-ray unit

. . . comes in two models featuring a power range of 150 kv., 3 ma. and penetration of 1⅞-in steel. The Baltospot 150-P incorporates a 360° X-ray tube for circumferential radiography, yet it is adaptable to single-beam or

directional use by means of an easily adjustable diaphragm, the maker says. The X-ray head weighs 55 lb. and the control panel 26 lb. Source: **Balteau Electric Corp., 5 New St., Stamford, Conn.**



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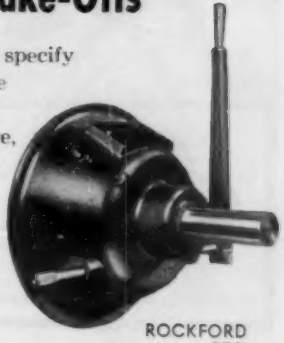

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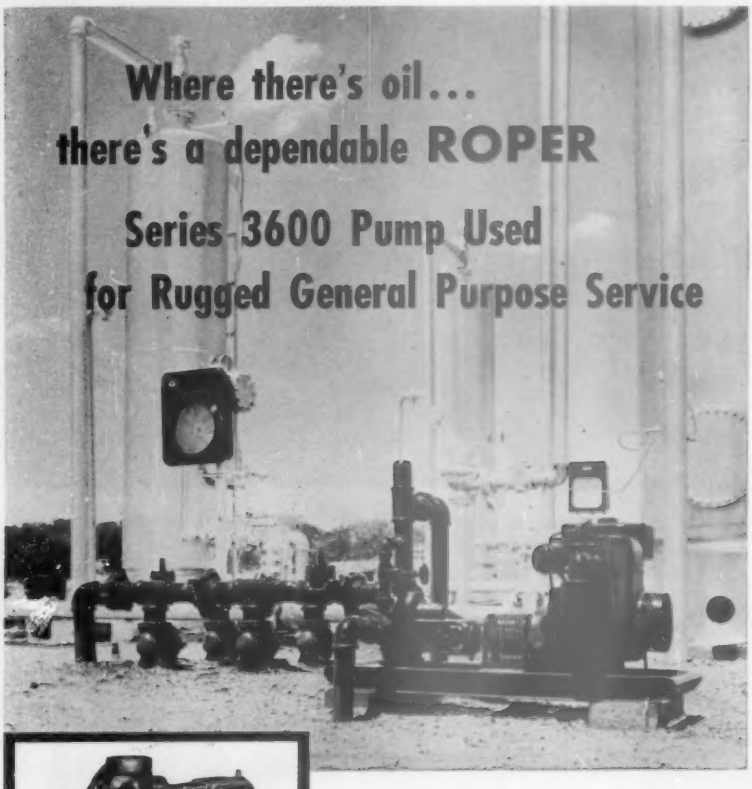
. . . for gasolines, fuels, and lubricants now on the market combines, the maker claims, the advantages of analog and digital computing and telemetering techniques to give low over-all equipment and installation costs and reliable operation.

Features include high-resolution readout of the computed formula, direct blending to transport loading or pipeline, fail-safe control of components, and uniformity of blend control and product. Source: **B-I-F Industries, Inc., 399 Harris Ave., Providence 1, R. I.**

Thermistors

. . . protect new motor from heat build-up in the motor winding. The Guardistor motor can be used for any a.c. application and provides protection, according to the maker, against overheating due to single-phasing, locked rotor, too-frequent starting, repeated overloads, high ambient temperature, abnormal voltage, ventilation failures, and switch welding. The contactless PTC thermistor, a semiconductor, is an integral part of the motor. Each one is encapsulated in epoxy resin before it is installed. Source: **Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.**



In the field, Roper Series 3600 Pumps are used for such applications as circulating and recirculating, pulling from test tanks, and for general transfer work.

Widely recognized for dependability, Roper Series 3600 Pumps are designed to handle thick or thin oil at slow speeds. Available in 40 to 300 GPM sizes, pressures to 100 PSI, they are fitted with two equal size helical pumping gears, heavy duty, high-lead bronze bearings, adjustable relief valve; with packed box or mechanical seal. Specify Roper . . . job-proved in oil fields everywhere!

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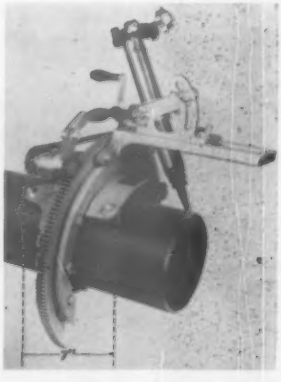
ROPER
ROTARY PUMPS



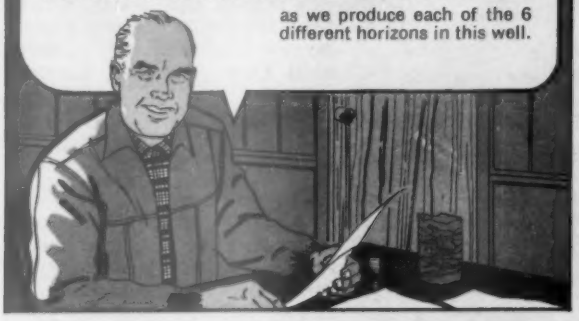
Pipe cutting

. . . and beveling machine recently announced offers a balanced-ring-gear saddle assembly that allows cuts on shorter segments of pipe than was possible with older machines. The machine, Model 1-SA, takes only about one-half the storage space of older machines, the maker says. Compared with older machines, the new model is lighter weight and handles easier too, a particularly valuable feature in the larger-size machines. Source: **C. A. Mathey Machine Works, Inc., 212 S. Frankfort, Tulsa, Okla.**

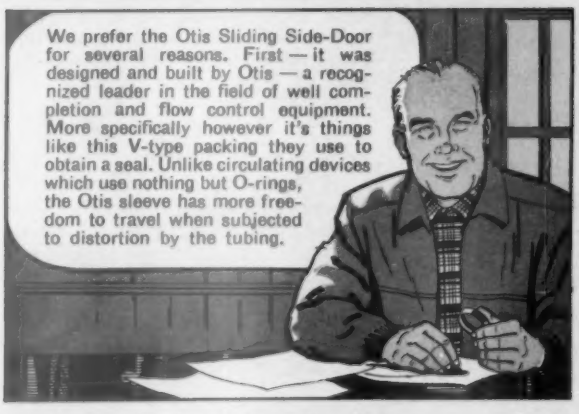
OTIS SLIDING SIDE-DOOR EQUIPMENT

WILL SAVE US SEVERAL HUNDRED DOLLARS PER ZONE

as we produce each of the 6 different horizons in this well.

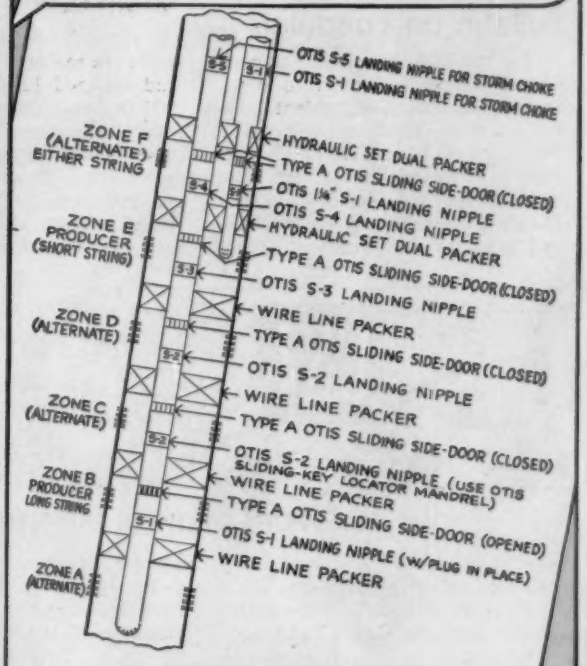


We prefer the Otis Sliding Side-Door for several reasons. First — it was designed and built by Otis — a recognized leader in the field of well completion and flow control equipment. More specifically however it's things like this V-type packing they use to obtain a seal. Unlike circulating devices which use nothing but O-rings, the Otis sleeve has more freedom to travel when subjected to distortion by the tubing.

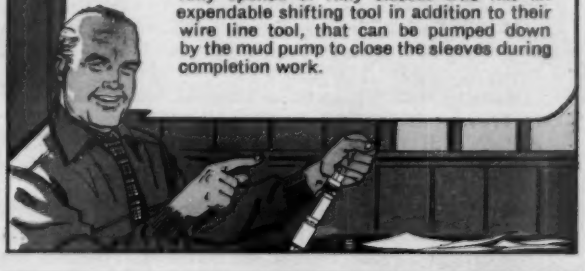


Then there's Otis' vertical slotted port design. This gives Otis Sliding Side-Doors maximum strength — and acts to prevent distortion of the tools as they are subjected to the stress and torque of a production string. Models with special pump-out plugs are also available to let you test your packer before nippling up the tree. Check the design advantages in this drawing.

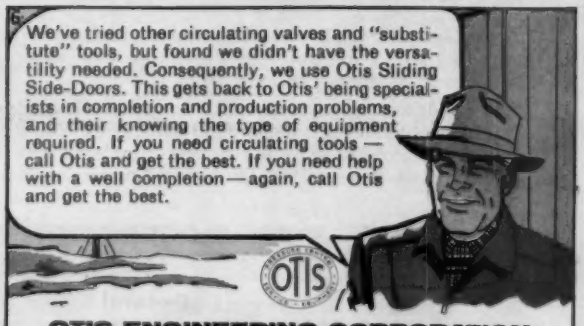
Add to that the thousands of dollars we saved by drilling only one well to produce these 6 formations and you'll see why we're sold on multiple-zone wells and Sliding Side-Door® equipment. Here's a diagram of the well.


OTIS S-5 LANDING NIPPLE FOR STORM CHOKE
OTIS S-1 LANDING NIPPLE FOR STORM CHOKE
ZONE F (ALTERNATE) EITHER STRING
HYDRAULIC SET DUAL PACKER
TYPE A OTIS SLIDING SIDE-DOOR (CLOSED)
OTIS 1⅛" S-1 LANDING NIPPLE
OTIS S-4 LANDING NIPPLE
ZONE E PRODUCER (SHORT STRING)
HYDRAULIC SET DUAL PACKER
TYPE A OTIS SLIDING SIDE-DOOR (CLOSED)
OTIS S-3 LANDING NIPPLE
ZONE D (ALTERNATE)
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE-DOOR (CLOSED)
OTIS S-2 LANDING NIPPLE
ZONE C (ALTERNATE)
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE-DOOR (CLOSED)
OTIS S-2 LANDING NIPPLE (USE OTIS SLIDING-KEY LOCATOR MANDREL)
ZONE B PRODUCER LONG STRING
WIRE LINE PACKER
TYPE A OTIS SLIDING SIDE-DOOR (OPENED)
OTIS S-1 LANDING NIPPLE (W/PLUG IN PLACE)
WIRE LINE PACKER
ZONE A (ALTERNATE)

Another advantage of this Otis equipment is that with their shifting tool they can open and/or close one or several sleeves with just one trip of the wire line. And you're sure the sleeves are fully shifted, too. Otis' shifting tools won't release until the sleeves are either fully opened or fully closed. Otis has an expendable shifting tool in addition to their wire line tool, that can be pumped down by the mud pump to close the sleeves during completion work.



We've tried other circulating valves and "substitute" tools, but found we didn't have the versatility needed. Consequently, we use Otis Sliding Side-Doors. This gets back to Otis' being specialists in completion and production problems, and their knowing the type of equipment required. If you need circulating tools — call Otis and get the best. If you need help with a well completion — again, call Otis and get the best.



OTIS ENGINEERING CORPORATION

General Offices: 6612 Denton Drive • Dallas

Branches Throughout the Oil Country

SHOWCASE . . .

New Literature

Bulletin on condulets

. . . for corrosive locations lists corrosive substances in tabular form with appropriate corrosion-resistant metals and finishes used in condulets. Twenty-page Bulletin 2699 also contains brief descriptions of the metals and finishes, and includes listings of Plast-A-Coat condulets for hazardous and nonhazardous locations. Source: **Crouse - Hinds Co., 1347 Wolf St., Syracuse 1, N. Y.**

Ninety-four chemicals

. . . of both organic and inorganic types are reviewed in a newly revised and enlarged 16-page digest. Bulletin 100-D gives information on 88 commercially produced chemicals and six development products. Included are more than 20 new or recently developed chemicals. It includes certain acids, alkalies, the elements chlorine and phosphorus, metallic salts, phosphorus compounds, sulfur compounds, chlorides, chlorobenzenes, and additional chemicals. The digest presents a thumbnail description, physical data, chemical formula, uses, and types and weights of shipping containers for each of the chemicals. Source: **Hooker Chemical Corp., Box 344, Niagara Falls, N. Y.**

Pipe-inspection

. . . method called Amalog, for casing, tubing, and drill pipe, is detailed in a four-page literature piece just made obtainable. According to the bulletin, the system locates all significant internal and external defects with electronic accuracy while greatly reducing the possibility of human error. Source: **Tuboscope Co., Box 808, Houston 1, Tex.**

1960 store directory

. . . of Baroid Div. of National Lead Co. contains locations and telephone numbers of division stores in 25 states, Canada, and foreign areas. Now being offered to interested persons, the 24-page publication lists separate geographical locales on different pages. Source: **Baroid Div., National Lead Co., Box 1675, Houston 1, Tex.**

Protective coating

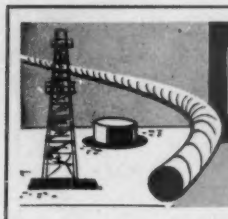
. . . called Niphos, made of corrosion-resistant metal, is detailed in a new eight-page bulletin just released. The Niphos process is a method of applying protective, firmly bonded metallic coatings without the use of electric current. The publication gives uses, advantages, installation data, and a corrosion test data chart. Source: **M. L. Sheldon & Co., Inc., 350 Lexington Ave., New York 16, N. Y.**

Synthetic methanol

. . . publication contains 36 pages of specifications, technical data, handling and storage, toxicity, uses, and test methods. Twenty - six easy - to - read tables point out properties, densities of methanol - water solutions, nomographs for increasing concentration of solutions, freezing points, vapor compositions at various pressures, thermal conductivity, etc. Source: **Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.**

Fuels and Lubricants

. . . Services is the title of an eight-page pamphlet which describes various activities of Snell's fuels and lubricants section, ranging from tests of



CSI

Practical ideas for BETTER Cathodic Protection

CAN YOU PROFIT BY THESE EXPERIENCES?

Corrosion of pipe and other underground structures continues to cost industry thousands of dollars—unnecessarily. Are you letting questions or doubts stop you from using **economical** cathodic protection? Here are some of the recent satisfactory jobs performed by CSI engineers.

116 Oil Wells (West Texas). 2 casing leaks had resulted from external corrosion in this field. CSI ran current requirement tests, then installed rectifiers and graphite anodes on each well. Cost was only $300 to $350 per well.

Pipe Line (Southern Oklahoma). This line is operated by a major company. A cathodic protection system using 15 rectifiers was installed. CSI furnished all materials, labor, 15-foot augers, ditchers and other necessary equipment.

30 Oil Wells (Western Kansas). CSI determined current needed to stop corrosion; then installed 6-ampere-output rectifiers on a turnkey basis. Cost: $300-$350 per well.

Housing Unit Piping (Ohio). The builder of this housing unit wanted to prevent leaks and lengthen the life of the underground piping system. CSI recommended and installed a protective system using magnesium anodes. Anodes were used to lessen stray-current danger to nearby structures.

29 Oil Wells (West Texas). One casing leak had already occurred in this field. CSI installed protective systems using special new rectifiers that deliver almost constant current output despite heavy rains or dry periods.

Pipe Line (West Texas). Experience indicated that leaks would become an increasing problem. Protection was required. CSI installed 600 magnesium anodes in only 10 days.

CSI engineers pioneered and are acknowledged experts in the cathodic protection of underground structures. You'll find them helpful and eager to discuss your corrosion problems. They offer engineering and installation services, plus brand-name supplies at competitive prices.

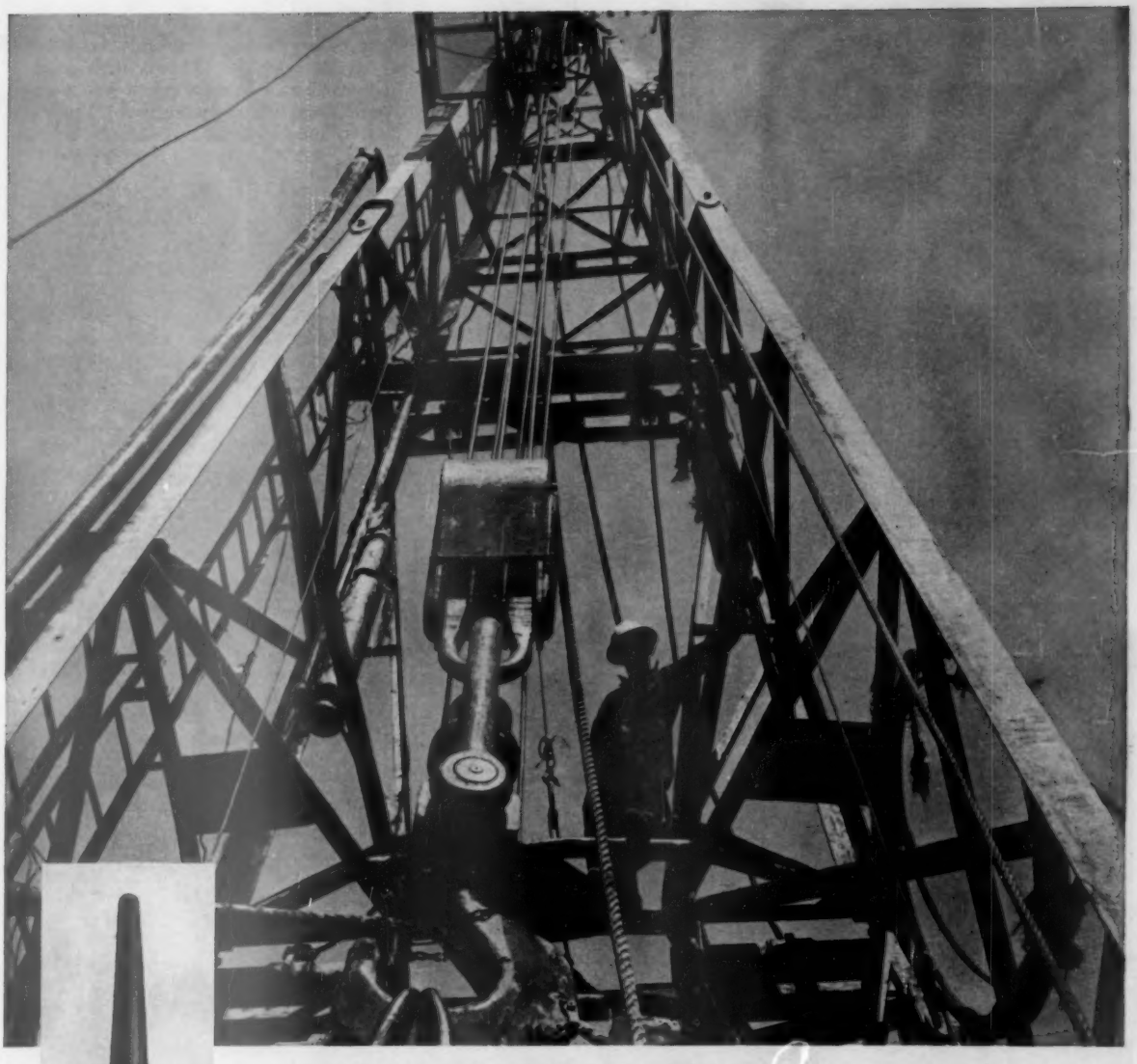
CSI

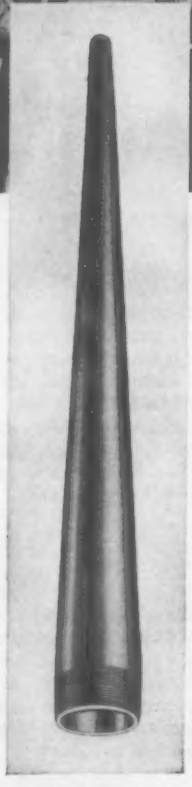
CORROSION SERVICES INCORPORATED

General Office: Tulsa, Okla.

Cleveland 13, Ohio
1309 Washington Ave.
Tel. CHerry 1-7795

Mailing Address:
Box 787, Sand Springs, Okla.
Tel. Circle 5-1351





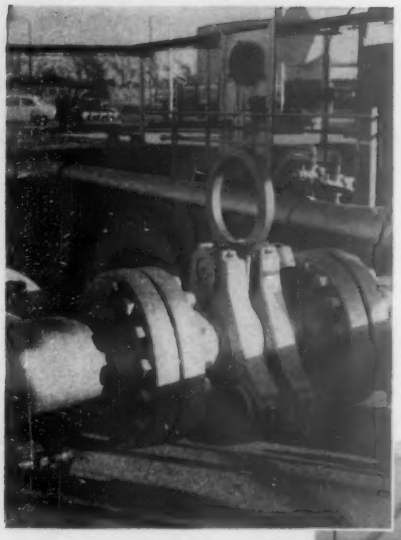
DEEPER AND DEEPER
with CF&I Seamless Casing and Tubing

The deeper wells and advanced equipment required for today's oil recovery demand the finest in casing and tubing — CF&I Seamless Casing and Tubing. The CF&I mill at Pueblo uses equipment rated among the most up-to-date in the industry. Production techniques feature unusually exact quality controls.

From its central location, CF&I Seamless Casing and Tubing can be distributed rapidly to the major oil fields. All CF&I Seamless Casing and Tubing is made to API specifications, in sizes 2⅜" to 9⅝" O.D. For full details, contact your local CF&I Sales Office or our General Sales Office, Denver, Colorado.

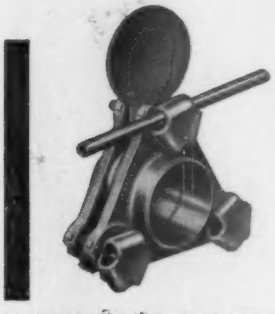
CF&I STEEL **SEAMLESS** *casing and tubing* API

THE COLORADO FUEL AND IRON CORPORATION
DENVER, COLORADO



FAST, EASY, POSITIVE
LINE BLINDING

Hamer
Line Blind Valves



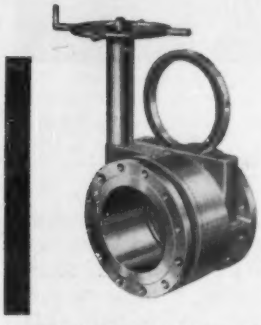
The famous 3-Bolt Hamer Line Blind Valve has set the standard for positive, dependable, economical line blinding in all industries.

FAST . . . because one man can reverse the spectacle plate from open to closed position in a matter of minutes.

EASY . . . because bar or handwheel operation provides tremendous leverage for spreading and tightening the hubs that hold the spectacle plate. Wedges, hammers, wrenches needed for spreading conventional flanges are eliminated.

POSITIVE . . . because nothing seals as securely and permanently as the solid spectacle plate clamped between the hubs of a Hamer Line Blind Valve.

Ask your nearest Hamer Line Blind Valve specialist about the multiple advantages of installing them wherever positive line shut-off is essential. Write for new Hamer Valve Catalog 60.



Handwheel operated Hamer Rigid Type Line Blind Valves are ideal for installation where conditions prevent spreading the line to reverse the spectacle plate.

WECO
WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION
HV-2-60
fmc

WECO UNIONS

CHIKSAN SWIVEL JOINTS

HAMER LINE BLIND VALVES

HAMER PLUG VALVES

routine nature to "trouble shooting" in specific problem areas and new-product development. The booklet mentions some successful endeavors in the past, and offers examples of routine tests and fees. Source: **Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y.**

Gas burners

. . . of various types, along with dimensions, weights, and applications, are described in new Catalog 571-300 now available free for the asking. It gives materials of construction, operating advantages, capacities, and installation data. A special five-page chart shows gas capacity of inspirator orifices in cubic feet per hour. Source: **Denver Fire Clay Co., 2301 Blake St., Denver, Colo.**

Oil-field products

. . . listed in a new 28-page brochure, just off the press, include sucker-rod and line strippers, casing and tubing swabs, blowout preventers, polished-rod lubricators, stuffing boxes with automatic sealing packing, tension tubing anchors, and cup-type packers. Pictures of products, along with price lists and informative data, are also given. Source: **Equipment Engineers, Inc., 2039 Amelia St., Dallas 35, Tex.**

Tank-gaging system

. . . which digitizes the output of any number of liquid-level gages in feet, inches, and eighths of an inch, is featured in new four-page Bulletin EA9. The publication includes photographs, system diagrams, component parts, and tank-gaging equipment. Source: **Control Corp., 718 Central Ave., N.E., Minneapolis 14, Minn.**

Vertical-pumps

. . . bulletin illustrates some basic designs of FloWay industrial pumps. The eight-page literature piece, just made obtainable, features C-line and V-line pumps and includes cutaways, photos, and specifications. Also included is information on packing boxes. Source: **Fiese & Firstenberger Mfg., Inc., Box 164, Fresno, Calif.**

Subsurface pumps

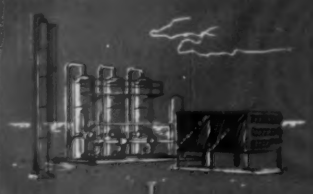
. . . for slim-hole completions using 1¼ or 1½-in. tubing are discussed in a new, obtainable bulletin. It contains illustrations of each pump (called "Little Squirt") assembly, along with alternate plungers, parts, and accessories. Source: **Harbison-Fischer Mfg. Co., Box 2477, Fort Worth, Tex.**

PROOF OF PERFORMANCE

CUSTOMERS REPORT QUICK COMPLETIONS, QUICK PROFITS, QUICK PAYOUT with PARKERSBURG DAU'S*

PROOF POSITIVE from the Texas Gulf Coast

A 36"-x 15' two-tower DAU was delivered in the field and assembled that same day . . . tied into the pipeline the following morning . . . turned on stream that afternoon. Now processes 5 million feet of gas, recovers 25 barrels per day. **Proof positive** that a DAU goes to work faster—produces profits quicker.

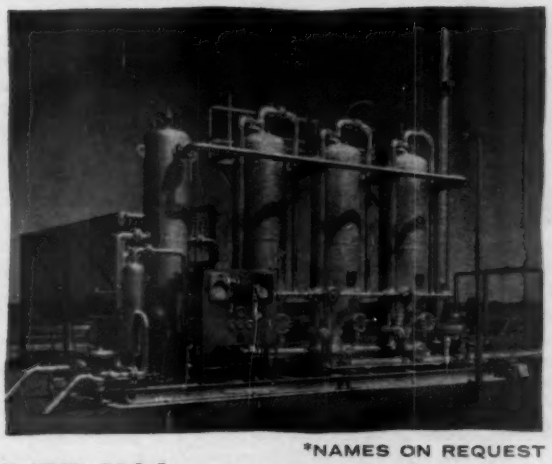


PROOF POSITIVE from South Texas

A 20" three-tower DAU was assembled and put on stream within 36 hours . . . now processes 4 million feet of gas per day. **Proof positive that Parkersburg's precision pre-engineering** and complete test assembly of DAU units in the plant enables quicker completions, maximum efficiency of operation.

PROOF POSITIVE from offshore Louisiana

On a small offshore platform where space is limited, but the job is big (18 million feet of gas to process), three 16" DAU's were installed . . . now provide quick, dependable dehydration, resulting in more salable pipeline gas in less time. **Proof positive** that there's a Parkersburg DAU for every hydrocarbon recovery and/or dehydration job.



*NAMES ON REQUEST

WHEN YOU BUY PARKERSBURG YOU GET 'EM ALL!

ENGINEERING . . . Parkersburg patents the process, not just the equipment.

MANUFACTURING . . . Parkersburg units are backed by rigid systems of quality control.

INSTALLATION . . . Parkersburg equipment installations are supervised by experts.

SERVICING . . . Parkersburg trains your men, services your unit any time, anywhere.

SEE YOUR PARKERSBURG MAN TODAY!

THE PARKERSBURG RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.

PARKERSBURG • HOUSTON • COFFEYVILLE

PARKERSBURG—The FULL LINE in Pressure Vessels . . . Separators, Metering Equipment, Treaters, Heaters, Knockouts and Oil Skimmers, Scrubbers, Hyrecos, Hydrocarbon Recovery Units, Glycol Dehydrators, Stabilizers.

▶▶▶ Equipment Men Notes

C. W. Penny named vice prexy

. . . and general manager of General Geophysical Co. (Bahamas), Ltd., Tripoli, Libya, according to the parent company, General Geophysical Co., of Houston. Since 1956, Penny has been vice president and general manager of the firm's South American subsidiaries in Caracas, Venezuela and Bogota, Colombia. A 13-year company member, he was supervisor of Louisiana geophysical operations from 1954 to 1956.

Ralph N. Brodie Co. names

. . . Riverview Supply Co., of Cape Girardeau, Mo., as meter sales representative for Brodie in 18 Missouri counties and 21 counties of Illinois. The report comes from E. D. Brodie, general sales manager of the San Leandro, Calif., company. Al Underwood is president of Riverview Supply.

Motorola appoints R. H. Davis

. . . as chief engineer of its microwave department, where he is responsible for microwave product development, systems engineering, and field engineering. He has been with the department since 1950. Davis served as a field project engineer for 4 years, then, in 1954, was appointed manager of microwave systems engineering. In 1958 he took on the added responsibilities of microwave publications.

Allen C. Johnstone becomes

. . . field representative at Edmonton, Alta., announces W. A. Weir, Canadian area manager for U. S. Steel Corp.'s Oil Well Supply Division. Johnstone joined the division at Edmonton in 1954. Since then he has served at Drayton Valley and at Swan Hills, Alta.

Nordberg Mfg. Co. announces

. . . the establishment of a new Kansas City headquarters to provide service to customers and prospective users of diesel engines. The report comes from R. W. Bayerlein, vice president of Nordberg's Engine Division.

J. T. Adams, Kansas City district manager for 12 years, will continue in that capacity. He will be assisted by J. A. Snarenberger, sales engineer, and G. Kreher and C. T. Pierce, service engineers.

J&L Supply appoints two

. . . new store managers, reports A. G. Bastian, manager of field operations. B. J. Rust, salesman at Big Spring, Tex., is now assigned as store manager there, and R. B. Bayless, salesman at Lindsay, Okla., takes over as store manager at that location.

Rust began his career with Jones & Laughlin as storeman at Anson, Tex. in 1947. He was promoted to store manager there 2 years later and became a salesman in 1952. Rust was transferred to Big Spring this year.

Bayless, who started as storeman at the Tulsa warehouse in 1935, was promoted to store manager at Hutchinson, Kans. in 1941. He was assigned as store manager at Borger, Tex. in 1946 and became a salesman at Pauls Valley, Okla. in 1952. Bayless was shifted to Lindsay in 1955.

Paul E. Paules assumes post

. . . as western regional manager for the Scientific & Process Instruments Division of Beckman Instruments, Inc., announces Roy F. Brown, marketing manager. A 10-year company veteran, Paules most recently served as sales manager for the western region.

In his new position he will manage sales and service operations for the division's western region, which includes 13 states and western Canada.

Metals center is opened in Tulsa

. . . by Bridgeport Brass Co., under the supervision of Philip E. Mason, Tulsa district manager. The new center will carry condenser tubes, aluminum fin stock, free machining brass rod, copper water tube and pipe, and refrigeration tube. The facility is equipped with automatic materials-handling system, loading dock, and cutting and deburring equipment for condenser tubes.

Tube-Kote starts construction

. . . on a $300,000 plant expansion in Harvey, La., according to E. G. Holm, executive vice president and general manager. The new facilities will include modern equipment for cleaning, coating, baking, and inspecting oilfield-tubular goods. Tube-Kote coatings are used for the prevention of corrosion and paraffin deposition.

Chicago Bridge & Iron sets up

. . . an engineering office in The Hague, The Netherlands to assist the company's European subsidiaries and licensees. Heading the new branch is Taavi Kaups, former member of CB&I's general engineering department in Chicago.

A. O. Smith Corp. receives

. . . orders totaling about $25,000,000 for large-diameter pipe to be used in natural-gas pipeline construction, and production of the pipe is under way, according to H. F. Detrick, vice president of the company's capital equipment group.

The orders were released by Natural Gas Pipeline Co. of America and Peoples Gulf Coast Natural Gas Pipeline Co., both subsidiaries of Peoples Gas System of Chicago.

The orders total more than 500 miles of pipe ranging from 24 to 36 in. in diameter. A part of the order, for the 36-in. pipe and some of the 30 in., will be manufactured by an A. O. Smith subsidiary, A. O. Smith Corp. of Texas, at Houston. The rest will be produced by A. O. Smith's pipe mill at Milwaukee.

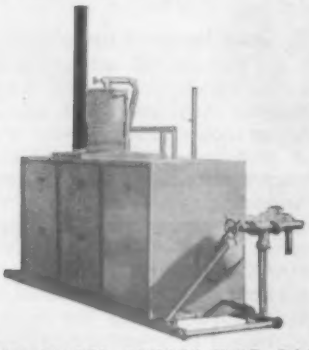
NEW "SERVICE" WAGONS of Walworth Co.'s Lubricated Plug Valve Division will provide customers with on-the-spot servicing of any LPV installation. The mobile valve shops also will visit new installations with Walworth service specialists to conduct courses in valve operation and maintenance.

Garrett Oil Tools promotes two

. . . in its engineering department, announces Taylor Milton, president of the division of U. S. Industries, Inc. Fred L. Magoon, Jr. has been promoted to manager of engineering, and Bolling A. Abercrombie has been named manager of production planning and evaluation.

Magoon went to Garrett last year from Fibercast Co. in Tulsa, where he

SAUDER HD-1 UNIDRYER



THE FINEST GLYCOL-TYPE GAS DEHYDRATION UNIT ON THE MARKET TODAY! Assures better gas-glycol contact . . . less glycol loss . . . greater flexibility with: less maintenance and easier maintenance. Units COMPLETELY WINTERIZED for cold-weather operation. We welcome your inquiries. Write or phone us today for complete information.

Sauder SAUDER TANK CO., INC.
Originators of the Econo-Pak

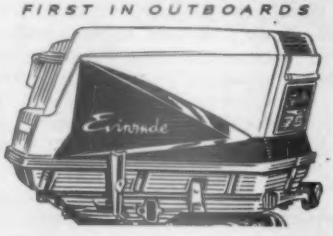
PHONE DI 2-2550 • EMPORIA, KANSAS

75 hp for boating's toughest jobs

The Evinrude Starflite II! Mighty power for a wide range of waterfront duties and commercial boating jobs. Smooth, quiet, tireless performer. Its V-4, 89 cu. in. engine develops 75 hp at 4500 rpm. You get outboarding's finest features: electric starting, automatic choke, sea-going magneto ignition, rugged Jetstream Drive, two-way shock absorbers. **Lowest cost per hp in history!**

Evinrude Motors, 4143 N. 27th St., Milwaukee 16, Wis.
A Division of Outboard Marine Corporation
In Canada: Mfd. by Evinrude Motors, Peterborough

EVINRUDE
FIRST IN OUTBOARDS



had been chief engineer for 8 years. Prior to his new appointment, he was administrative engineer—product design and production services.

Abercrombie had been serving as administrative engineer — production, test, and evaluation. He joined Garrett in 1955 and moved to the division's home office in 1958, after serving as a sales engineer in the Houston district.

Bowen Itco, Inc. signs lease

. . . with Rockefeller Center, Inc., for executive sales offices in the General Dynamics Building, 1 Rockefeller Plaza, New York City. Bowen Itco's manufacturing plant and main offices are located in Houston. In addition to its New York office, the company has 19 other branches located in the oil centers of the United States.

Occupancy of the Rockefeller Center space will be under the management of Louis P. Siracusa, Bowen Itco's eastern division sales manager.

Welex opens service location

. . . in McCook, Neb., and places Sales Engineer R. E. Sandlin in charge. Other personnel at McCook, which is part of Welex's Kansas division, include Field Engineers L. R. Weathers and J. D. Widders. All transferred from Hill City, Kans.

Other recent company promotions include: L. A. Cobb, from Houma assistant district manager to Houston division engineer; R. B. Hamill, from Great Bend division engineer to Houston field service section; J. R. Trainer, Jr., from Odessa shooter to Snyder field engineer; D. L. Coulthard, from engineer trainee to field engineer at Farmington; J. W. Webb, from operator to sales engineer at Pauls Valley; and D. L. Divine, from engineer trainee at Houston to Odessa sales engineer.

Recent transfers include: Field Engineer E. G. Roberts, Jr., from Winfield to Tyler; District Manager C. P. Stewart, from Kimball to Pratt, Field Engineer J. L. Everette, from Brookhaven to Mission; District Manager Troy Moran, from Brookhaven to Alice; Field Engineer W. E. Nidiffer, from Snyder to Shawnee; Assistant District Manager R. W. Thompson, from Monahans to Abilene; Sales Engineer F. L. Kieffer, from Stillwater to Pampa; and Field Engineer H. J. Terhune; from Great Bend to Pampa.

Hutchison Mfg. Co. appoints

. . . Cox Oilfield Equipment Co. as its Rocky Mountain area representative handling Hutchison's Rumba shale shaker for drilling rigs, Flolight vapor-tight derrick lighting systems, and

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component lighting equipment. Headquarters of Cox are in Casper, Wyo.

Dr. John Mason is appointed

. . . to the research advisory committee on nuclear energy systems for the National Aeronautics and Space Administration (NASA). Mason is chief of preliminary design for Garrett Corp.'s AiResearch Mfg. Co., of Los Angeles.

The nuclear energy committee serves in an advisory capacity to NASA on its research programs in the application of various reactors to vehicle propulsion and the application of reactors to turbomachinery and vehicle power generation.

Don L. Baxter, Inc. moves

. . . its headquarters from the Melba Building in Dallas, from where the firm operated for 14 years, to Dallas' Corrigan Tower Building. The advertising and public relations agency now occupies 6,000 sq. ft. of space tailored to agency specifications. An additional 2,000 sq. ft. is available for future expansion.

W. R. Barry Pump Co. appoints

. . . Max E. Landry, Inc., of Tulsa, as authorized exclusive sales agency for Barry V60 quadruplex plunger pumps.

Weldon R. Burns assumes post

. . . as engineering manager of Badger, Ltd., London affiliate of Badger Mfg. Co., Cambridge, Mass. Burns joined the British firm following his assignment as project manager on the $50,000,000 Esso Rotterdam refinery recently completed by Badger N.V., The Hague.

Burns went to the Badger organization in 1957 after 24 years of refinery engineering experience with Bell Oil & Gas, Northwestern Refining, Frontier Refining, Catalytic Construction, and Badger's predecessor, E. B. Badger & Sons.

Hills-McCanna Co. promotes

. . . Ralph Huft to sales promotion and advertising manager, according to Richard I. Allen, vice president of the Chicago firm. Huft, with Hills-McCanna for the past 12 years, previously served in various field and internal sales management capacities.

Philip T. Rogers, regional manager, also announced that five firms have been appointed as authorized stocking distributors for valves. They are: Ernie Graves Co., Tulsa; Ft. Wayne Pipe & Supply Co., Ft. Wayne, Ind.; Wilkins Pipe & Supply Co., Peoria, Ill.; A. P. Englehart Co., Flint, Mich.; and Harry W. Taylor Co., Detroit.

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This is what a large number of mud tanks look like on drilling barges all up and down the coast.

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Just add weight and gel to the mud through a high-speed LIGHTNIN Flash Mixer and you get an immediate rise through the whole system. Within a few minutes, weight and viscosity are completely equalized.

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Ask your LIGHTNIN sales engineer or supply company representative to show you a nearby rig where LIGHTNINS are at work. He'll arrange a field trip to a barge or land rig in your area.

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MIXCO fluid mixing specialists

LIBYA IS DESTINATION for the world's largest mobile drilling rig. The Desert Rambler No. 2 will travel across the desert on five Kenworth-drawn trailers with 21:00 by 25-in. tires.

Big rig headed for Africa

THE WORLD'S biggest trailer-mounted rig has been recently completed and is headed for action in the North African desert.

This is the second rig of its type. The first, a smaller one, is already at work in North Africa.

The new rig—Desert Rambler No. 2—will drill in Libya for Camdrill International, Inc. Built by Ideco, Inc., the giant mobile rig will traverse some of the most rugged country in the world. Completely self-contained, it will move distances of 1,400 miles on roadless North African sands on five huge semitrailers fitted with 21:00 by 25-in. sand tires. The tractors are five Kenworth diesel trucks.

The new rig contains a number of refinements which Ideco engineers claim make it a showcase of "Fifty years of rig design wrapped up into one package." The unit is designed to drill to 10,000 ft. with 4½-in. drill pipe. It operates directly from its transport trailers, one each for carrying the mast, the draw works, two for accommodating the slush pumps and mud system; the fifth is equipped with a complete maintenance shop.

Fully equipped, the trailers weigh from 68,000 to 159,000 lb. Their respective lengths vary from 47 to 78 ft. A total of 1,500 hp. is supplied to the draw works, rotary table, and pumps by four D397 Caterpillar engines which have Clark 24-in. torque converters. For lighting and auxiliary equipment, four Cat engine-generator sets provide a total of 330 kw.

Desert heats up to 130° F. are combated by oversized radiators and lightweight metal shade panels. To fight the dust, dual fuel and air filters are used.

To move the rig, only the chain from the draw-works compound to the rotary table is disassembled. The draw-works trailer contains an Ideco H-525-d double-drum drilling and workover hoist, and two Cat D397 engines with 24-in. torque converters with 3-to-1 stall-torque ratio. The draw works and rotary table are driven by this package through a three-shaft compound.

In drilling position, the mast trailer is connected back-to-back with the draw-works trailer. The 127-ft. Ideco mast is raised from the horizontal carry position. A 300-hp. slush pump mounted on a separate trailer is driven by the third Cat diesel. The fourth trailer contains an Ideco 600-hp. slush pump, driven both from the fourth Cat engine and a propeller shaft from the draw-works compound.

The mud-manifold system is built into the pump trailers, reducing rigup time, and can operate the pumps sin-

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gly or in compound. Storage bins are built into the pump trailer and a 5,000-bbl. mud tank is provided.

Operating conditions of the engines was set at reduced horsepower so that the draw works are not overloaded and engine lift is extended. The chain-driven slush pump requires the torque converter to take a side load. The output shaft of the converter is capable of handling this side load thus eliminating the need for additional shaft bearings and a flexible compound.

The entire design of the trailer-mounted rig emphasizes reliability of power. Field experience of over a year's trouble-free operation with the initial Desert Star unit proves that the basic design is good.

Active Rigs*

	Rotary	Cable	Total†
Alabama	6	0	6
Alaska	7	0	7
Arizona	1	2	3
Arkansas, South	15	0	15
California, Offshore	4	0	4
Inland	116	0	116
Colo., excl. Four Corners	24	5	29
Four Corners	12	1	13
Florida	2	0	2
Georgia	3	0	3
Idaho	1	0	1
Illinois	38	11	49
Indiana	16	30	46
Iowa	1	0	1
Kansas, western	103	11	114
Kentucky, western	6	37	43
Louisiana, North	87	0	87
South Inland	218	0	218
Offshore	69	0	69
Michigan	46	38	84
Mississippi	54	0	54
Missouri	0	0	0
Nebraska, East	0	0	0
West	14	0	14
Nevada	5	1	6
New Mexico, East	80	24	104
West	43	6	49
North Dakota	18	0	18
Oklahoma, Panhandle	18	15	33
Ohio	3	98	101
Oregon	1	0	1
Pennsylvania, North and Middle	0	57	57
South Dakota	2	0	2
Texas, Offshore	1	0	1
East	53	0	53
Upper Gulf Coast	99	0	99
North	108	0	108
Panhandle	44	8	52
Corpus Christi	115	0	115
San Antonio	47	5	52
West	211	13	224
West Central	81	20	101
Utah, North	9	0	9
South	19	0	19
Washington	2	0	2
West Virginia	5	222	227
Wyoming	65	5	70
Reported U. S. total	**1,872**	**609**	**2,481**

*Report to AAODC by the International Oil Scouts Association. †As of September 2, 1960. Not reported: Arkansas, North; Kansas, eastern; Montana; New York; Oklahoma, except Panhandle; Pennsylvania, South; and Tennessee.

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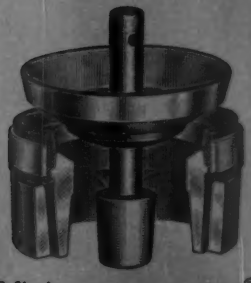

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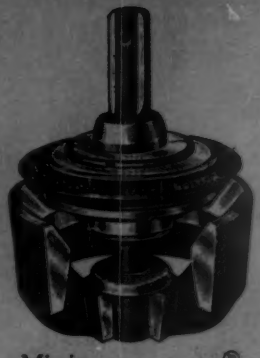

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Lisbon is bustling at both ends

BY FRANK J. GARDNER

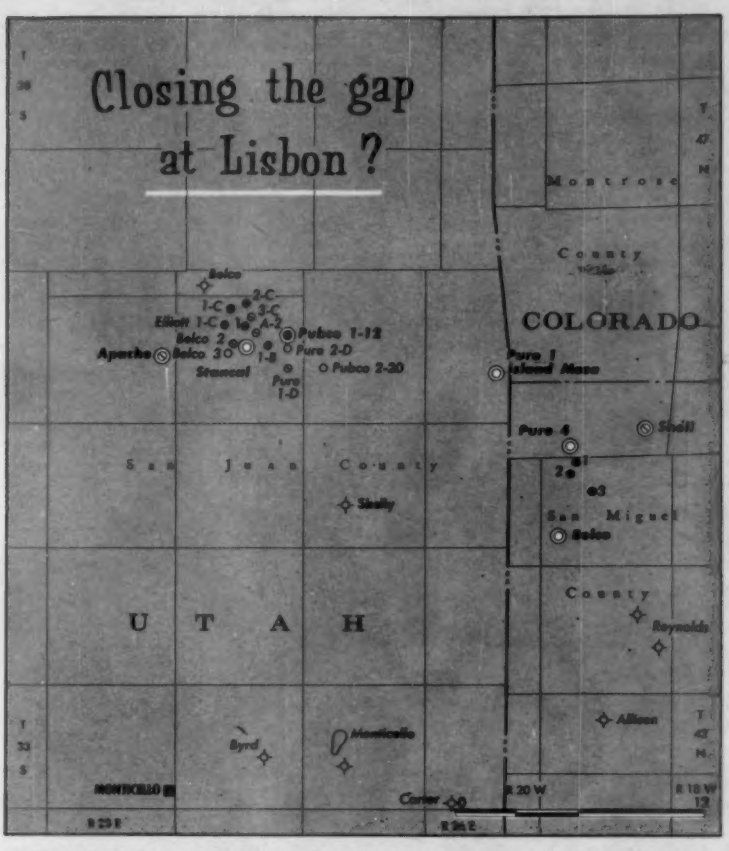
SELDOM is this column devoted to a single area three times in as many months. But things have popped so fast and so importantly along the Colorado-Utah line that they cannot be ignored by any observer of the exploration scene. The two-state Lisbon anticline has dominated the Rocky Mountain news for weeks now, and all signs point to more of the same.

Double-barreled action . . . In the past 10 days, Northwest Lisbon has racked up a flush new extension well 2 miles east of previous production, a new operator has entered the play, a sixth good producer has been indicated north of the field in a new pay zone, and a critical wildcat to the southwest has reached the testing stage. All these developments are in San Juan County, Utah.

At the other end of the anticline, at Southeast Lisbon in San Miguel County, Colorado, Pure Oil Co. has announced location for its fourth test, as predicted (OGJ, Sept. 5, 1960, p. 215), north and west of previous Pure wells, Belco Petroleum Corp. has moved into the play with a new wildcat southwest of the field, and a vital link wildcat between the two fields has been announced by Pure just west of the state line, back in Utah.

Perhaps the most encouraging of these developments was at Pubco Petroleum Corp.'s 1-12 Federal (Section 12-30s-24e). This outpost well, 2 miles east of earlier Northwest Lisbon producers, has made three successful tests of the Mississippian section, one at 8,388-8,507 ft., another at 8,516-8,610 ft., and another at 8,609-8,712 ft. All flowed gas and condensate; the third and most promising test recovered 91 bbl. condensate and flowed gas at a daily rate of 1,706 M.c.f. in a 1½-hour period. Pubco is drilling ahead.

At about the same time, Pure announced abandonment of its 2-C USA (Section 3-30s-24e) as far as Mississippian and Devonian hopes are concerned, but continues to test a possible new pay horizon for the Utah field. On latest reported test of the Paradox-Pennsylvanian salt zone at 5,844-6,132 ft., the well flowed 299 bbl. of oil in 5¼ hours, using a ½-in. choke. If completed at this level, the Paradox basin will have its first commercial producer from this pay.



INTEREST GROWS ALL ALONG the big Lisbon anticline astride the Colorado-Utah state line as the sixth producer is added to Northwest Lisbon, the third to Southeast Lisbon, and wildcats are staked in an effort to link the two producing areas.

Three miles southwest of Northwest Lisbon producers, Apache Drilling Co. is coring the McCracken-Devonian at the 9,200-ft. level; first recoveries were not too encouraging, but if Apache makes a well here, the entire Lisbon play will take on new meaning. The Mississippian in this test had no significant shows.

Meanwhile, Standard Oil Co. of California has bowed into the Lisbon scene with announcement of its 21-15 Arnold on the south flank of production in Section 15-30s-24e.

May close a gap . . . Events at the southeastern lobe of Lisbon in Colorado may have more far-reaching effects. Pure, in staking location for its 1 Island Mesa, in Section 22-30s-26e, San Juan County, Utah, has served notice it intends to pursue its campaign up and down this salt anticline. The wildcat lies 8 miles east of Northwest Lisbon and 5 miles northwest of Southeast Lisbon.

The company has just finished successful tests of its 3 SE Lisbon-USA to give the field its third producer. On the heels of that development, Pure staked its fourth test a mile northwest of the discovery well; it will go down in Section 31-45n-19w.

Yet another important wildcat looms in Section 30-44n-19w. This is Belco's 1 Unit, 4 miles southwest of the three producing wells at Southeast Lisbon. It will be a Mississippian test to 9,500 ft.

That's a lot of activity for a region that less than a year ago was an undrilled question mark. But what has happened here in the past 10 months may be nothing compared to what might happen during the next 10. The gap may close.

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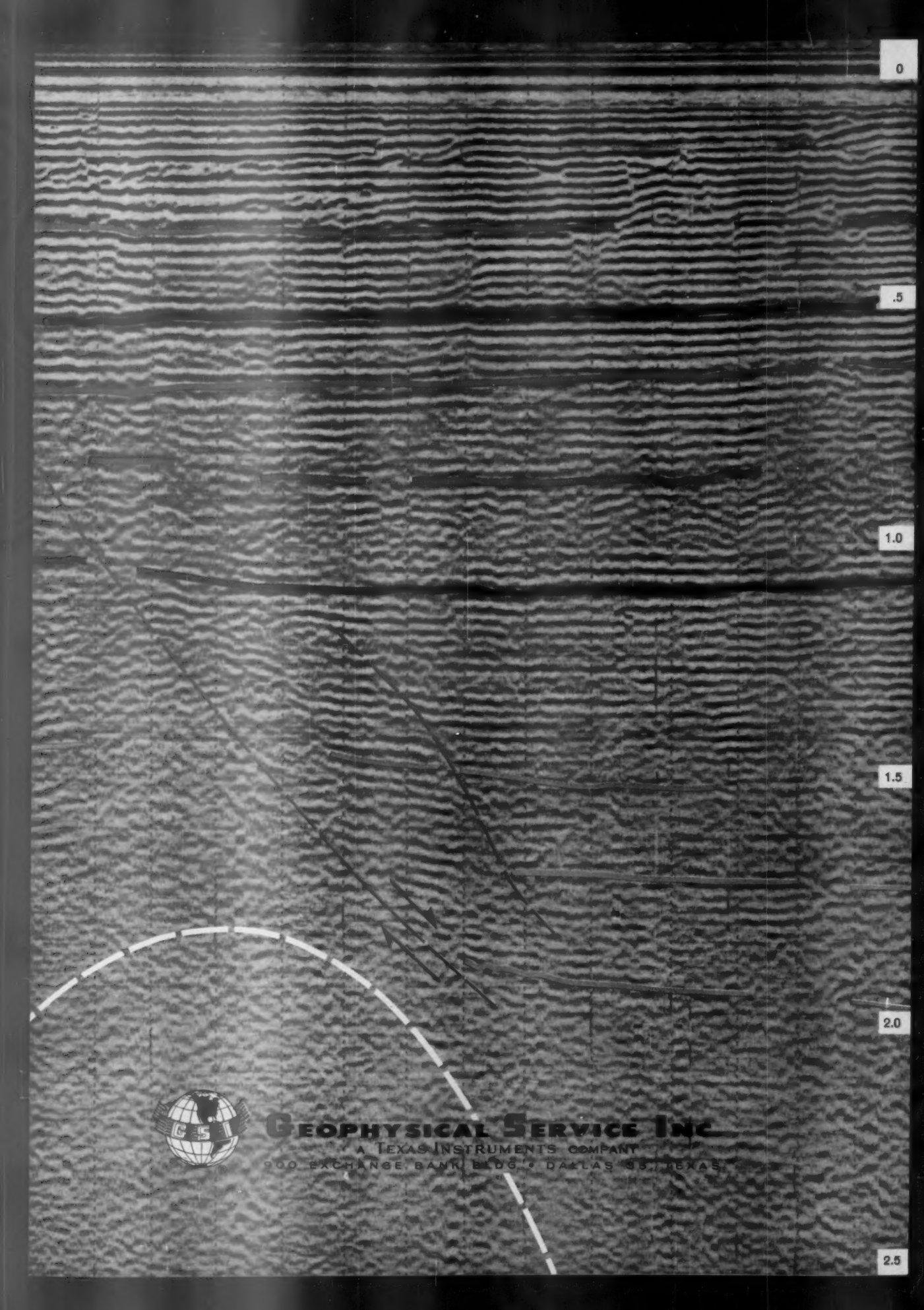
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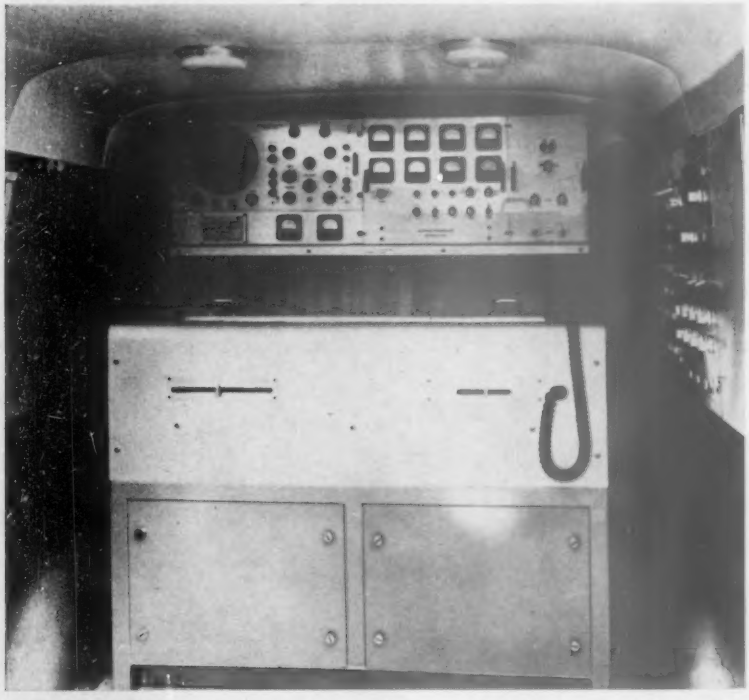
THE BASIC EQUIPMENT for the Stomper method is this self-propelled weight-dropping vehicle. Weights of 3 to 5½ tons are mounted between the wheels to minimize oscillations of the vehicle. Dropped at heights of 8 to 9 ft., location can be changed and dropped approximately once each 12 seconds. Fig. 1.

Here's how oil hunters use

the stomper as a seismic tool



FIELD-RECORDING instrument truck provides magnetic-tape storage of data. Corrections for impact time are automatically applied by a servosystem. Fig. 2.

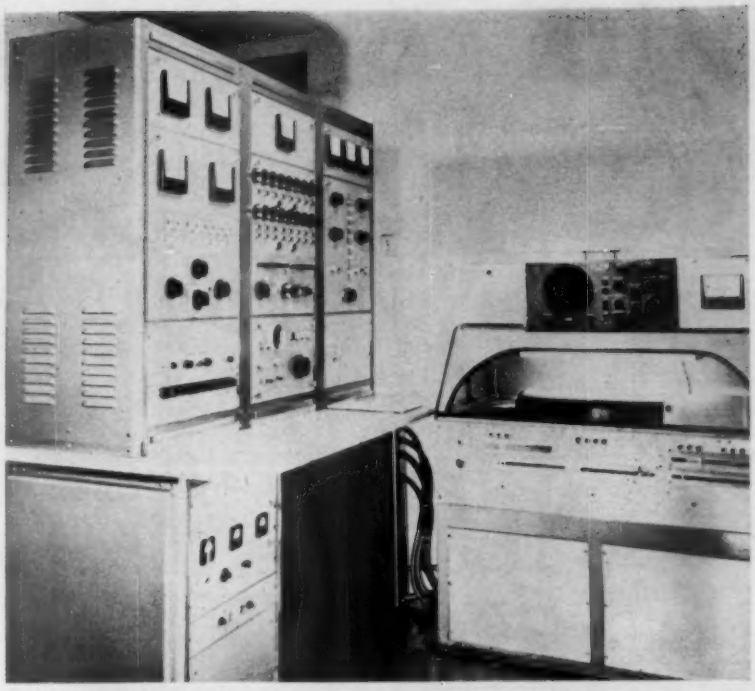
THE GERMANS were among the first to experiment with a seismic weight-dropping technique. In Germany during 1924 and 1925, F. Hubert of the Gottinger Geophysical Department conducted weight-drop seismic experiments. He used weights from 20 to 117 kg., dropped at heights of 1-11 m. A Weichert seismometer with a gain of 2,000,000 was used to record on photographic paper. Both 110 g. of black powder and a falling weight of 117 kg. at 11-m. height produced reflections from depths of several kilometers from a single drop.

Several other investigators experimented with falling weights during the 1920's. Among them was Dr. Burton McCollum who was first with a commercial application of the methed during 1953. A falling weight was used to generate seismic waves, and magnetic recording with integration was used. Two contractors and several of the major oil companies are now using this method. About 20 weight drop crews are now in operation.

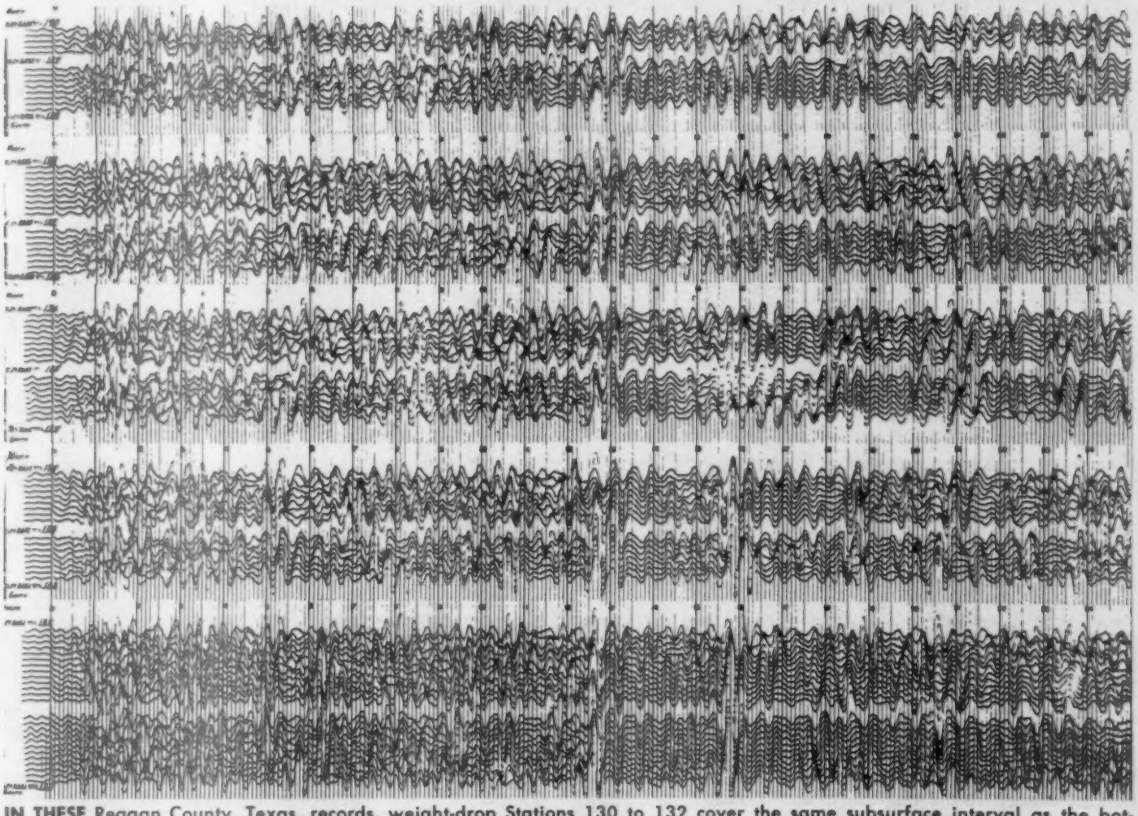
Equipment. Field equipment as used today consists of a weight of from 6,000 to 11,000 lb. mounted on a vehicle. A drop height of 8 to 9 ft. is

About the author...

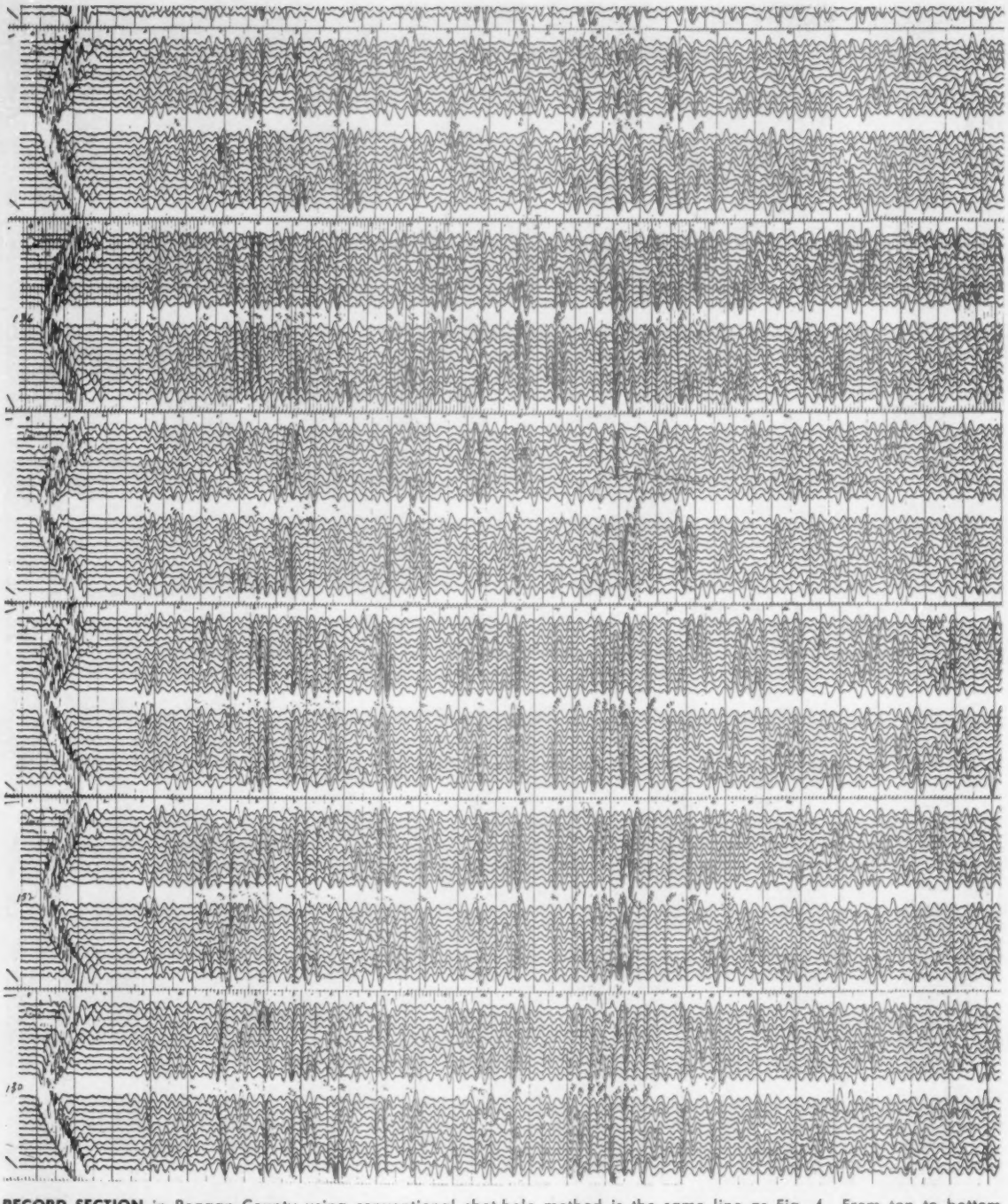
CHARLES L. KIMBELL served as navigation officer with the U.S. Air Force on combat duty from 1941 to 1943 and in navigation instrument development from 1943 to 1945. He received a BS degree in physics from the University of Houston in 1948. This was followed by post-graduate work in instrumentation along with duties as a navigation instructor at the university. While employed by Houston Technical Laboratories from 1948 to 1950, he participated in design and development work on the Worden gravity meter. From 1950 through 1955 he was employed by McCollum Laboratories, engaged in instrument design and field experimental work directed at the improvement of seismic methods. In 1946 he was an organizer of Geophysical Integrators which in 1959 merged into Independent Exploration Co. During this time he was engaged in equipment development work and in organizing seismic field operations. At the present he is electronics department head of the "Stomper" Division of Independent Exploration Co.



OFFICE PLAYBACK machine is used to make record sections. Note record coming off the instrument at right. A trailer-mounted record analyzer playback unit can run off magnetic tapes for experimental shooting techniques. Fig. 3.



IN THESE Reagan County, Texas, records, weight-drop Stations 130 to 132 cover the same subsurface interval as the bottom record (Fig. 5) in the record section. Spread length is 1,320 ft. Drop pattern on bottom record was 24-drop diamonds and drop interval of 21 ft. The other records use a 2,000-ft. spread length with 144 geophones per trace and 48-drop diamond in the drop pattern. Fig. 4.

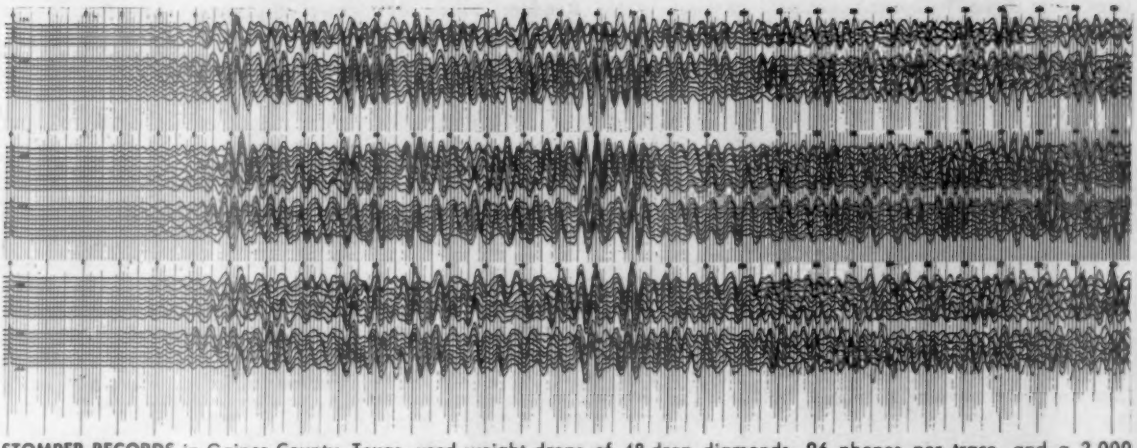


RECORD SECTION in Reagan County using conventional shot-hole method is the same line as Fig. 4. From top to bottom is north to south. The surface consists of a thin mantle of soil with caliche close to the surface. Shot point depth is 252 ft. deep, spread length is 1,320 ft. and 24 phones per trace. Ellenburger reflector is at 1.6 seconds. Note the down-to-the-south fault on the north spread of the record third from the top. Fig. 5.

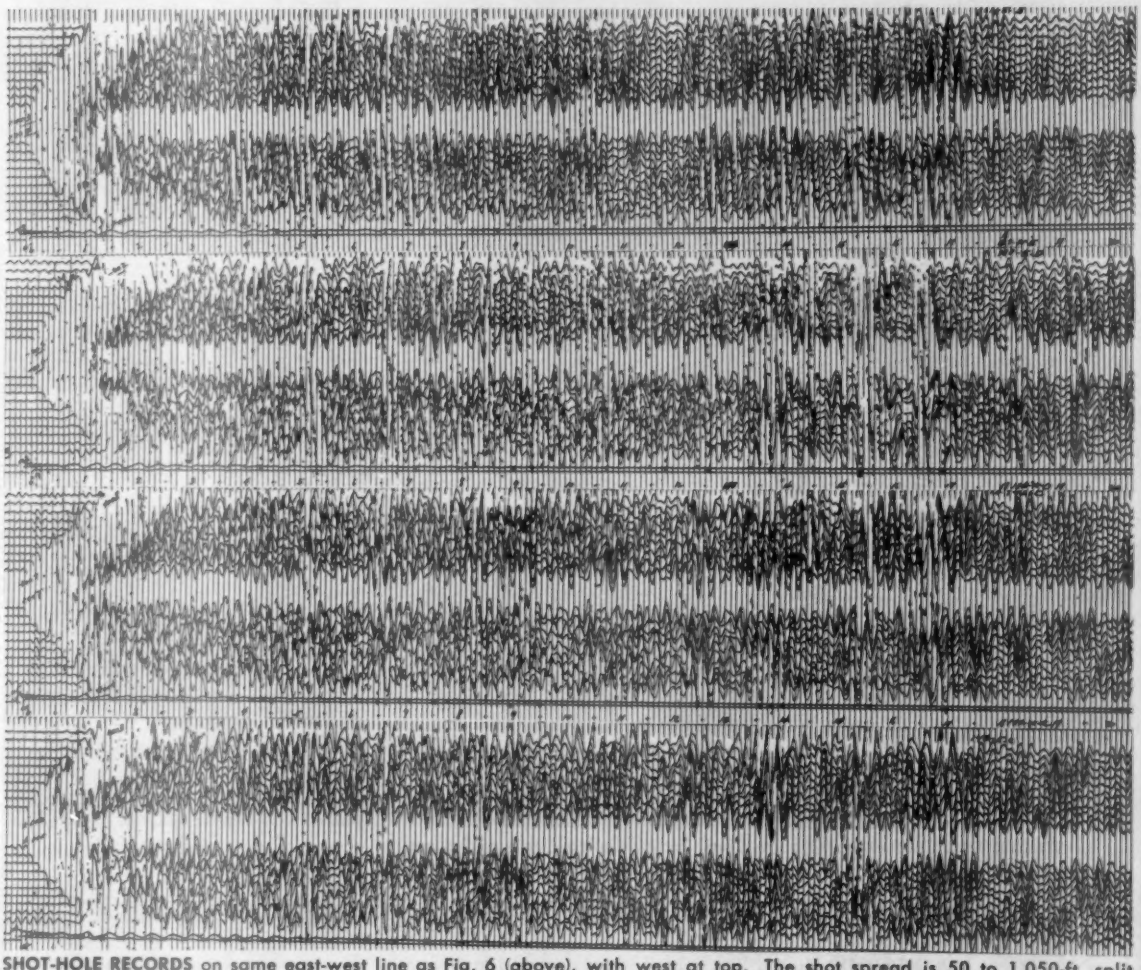
used. The weight may be raised, location changed, and dropped approximately once each 12 seconds. A large base area provides the most efficient coupling of energy into the ground. Seismic energy from a single drop normally is equal to that produced by 4 to 8 lb. of dynamite.

The magnetic field recorder is equipped to record sequentially the seismic signals. (Mayne 1956). Subsequently, after these recordings are aligned for time differences, they are integrated to improve signal to noise ratio.

Field procedure. The drops are placed in patterns. Multiple geophone patterns are also used. Reflected energy is recorded on magnetic tape in the field. Normally two geophone stations are placed 2,000 ft. apart. The drop patterns are then placed in line between the geophone stations. In some cases much improvement in record quality results from the use of an "in line extended" drop pattern. Drop



STOMPER RECORDS in Gaines County, Texas, used weight drops of 48-drop diamonds, 96 phones per trace, and a 2,000 to 4,000-ft. extended pattern. Drop interval was 31 ft. Surface consists of deep blow sand. Fig. 6.



SHOT-HOLE RECORDS on same east-west line as Fig. 6 (above), with west at top. The shot spread is 50 to 1,050-ft. split spread, using a three-hole shot pattern at 68-ft. depth and 60-lb. charge. Reflectors on both Figs. 6 and 7 are: Yates at 0.6 second; Glorietta at 0.9 second; Sanandrist at 0.8 second; Clearfork at 1.1 seconds; Mississippian at 1.6 seconds; and Devonian at 1.7 seconds. Fig. 7.

patterns and geophone patterns are used to provide improvements of signal to noise ratio on the finished record.

In Mississippi, experience has shown that a composite of 12 to 24 weight drops is sufficient to provide good record quality in many areas. Suppression of multiple reflections is possible. The wave path of multiple reflections, in lower velocity material, will cause a normal moveout which is greater than that of direct reflections. Therefore, compositing will tend to suppress multiples, direct reflec-

tions being aligned by normal moveout corrections while the multiples are not aligned. Integration of energy from different spread lengths but a common subsurface area is used or "multiple coverage."

Ghosting cannot occur because the seismic source is at the surface.

Data-processing equipment. After field data is recorded, it is processed by an analyzing machine. This playback machine corrects the field data for variations in elevation and weathering. It also compensates for the moveout caused by the different spread lengths between the drop position and the receiving geophones. By the process of integration, records are improved. In difficult areas background noise often obscures reflected energy. Integration improves the signal-to-noise ratio of seismic records. (Klipsch 1936) Random noises are suppressed by an amount proportional to the square root of the product of the number of geophones multiplied by the number of drops in the pattern. It is not uncommon to provide 288 geophones in a group and composite 384 weight drops recorded from these geophones. Thus it is apparent that we have a powerful tool that may be used to advantage in the most difficult record areas.

Advantages of this method. The increasing use of weight-drop equipment in the past few years has resulted from improved record quality that may be obtained and in many cases at less cost per mile of profile. Items that add additional cost to conventional seismograph are: bit costs, dynamite and cap costs, and permit costs. The weight drop eliminates all except the permit fee. Permits for weight drop work are usually $50 per day. Landowners normally do not object to operations of this type because no explosive is used.

The weight impact has been found to benefit pasture land because it pulverizes soil, liberating minerals beneficial to grass, and slightly pits the soil allowing water to penetrate the ground more easily. Surprisingly, the soil is not compacted but is pulverized and loosened by the impact. This results from the compression of air within the soil and the sudden release of this pressure caused by the flat base of the weight.

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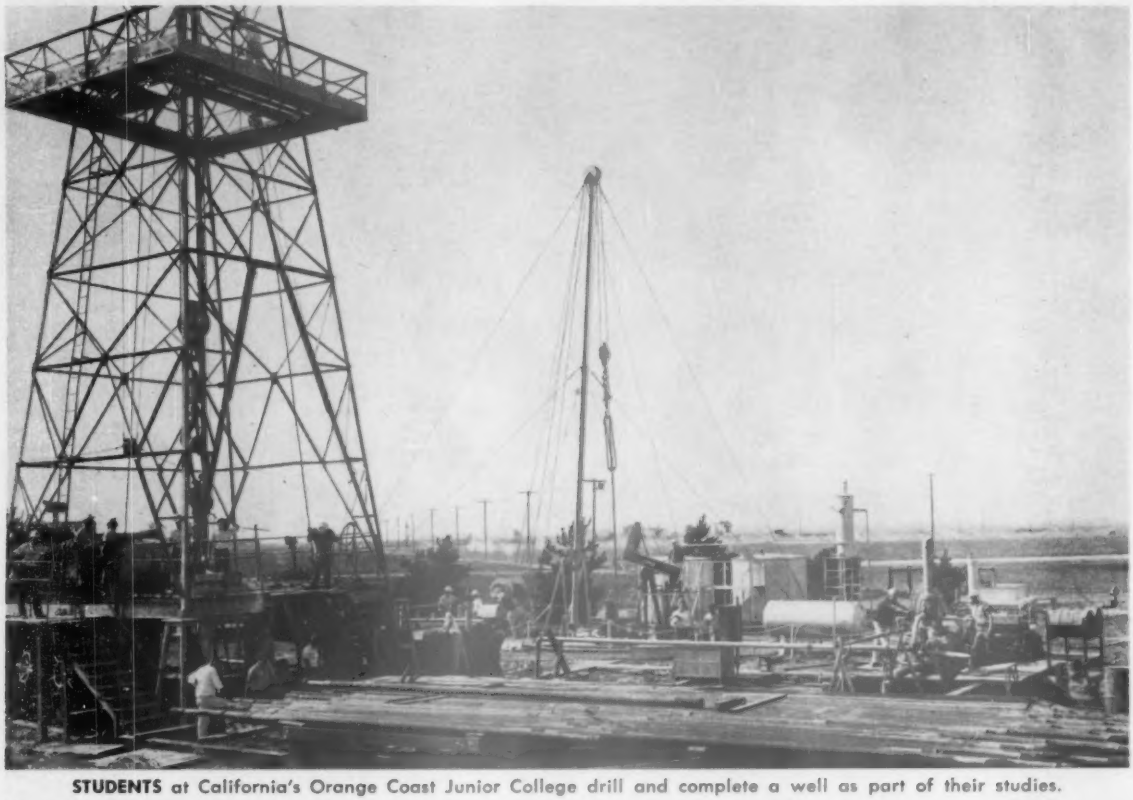
Klipsch, P. W., Geophysics, Vol. 1, pp. 365-377, 1935.



STUDENTS at California's Orange Coast Junior College drill and complete a well as part of their studies.

California students drill well for "homework"

A SOUTHERN CALIFORNIA junior college which offers a course specializing in training students for oilfield jobs is preparing to open its petroleum classes for the twelfth year.

Orange Coast College at Costa Mesa, Calif., has several advantages for the high-school graduate who plans a career in the oil business. The school is not designed to compete with regular 4-year colleges offering bachelor degrees in geology, petroleum engineer, or similar courses, but is equipped to turn out graduates who want to step into field jobs in the industry.

One asset the college has is its location. It is within a few miles of some of Orange County's fields where the students get a first-hand look at both onshore and offshore installations. And the college is free. At least, there is no tuition. Anyone who qualifies can attend.

George L. Guthrie, who teaches the petroleum courses, is a former geologist and production man who worked

for Carter Oil Co., Magnolia Oil Co., and Wilshire Oil Co.

During the 28 petroleum courses, students do the actual work of drilling and completing a well. The college has a standard rig and production equipment as well as some laboratory equipment. Guthrie says students frequently get a chance to test experimental equipment which is being developed before being offered to the industry.

The courses at Orange Coast cover five broad areas: exploration, drilling, production, oil-field machinery sales, and technician ratings. The latter includes such jobs as engineering assistants, mud engineers, directional drilling engineers, laboratory assistants, and well loggers.

Enrollment is normally small, running between 10 and 27 students. However, the college has no problem placing the graduates. Guthrie said he could have placed twice the number of students who graduated last spring.

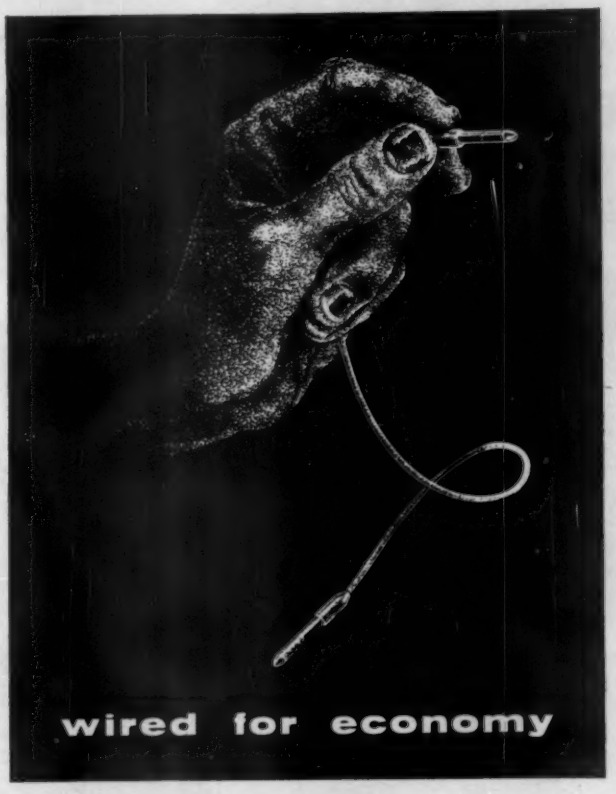
Utah's Lisbon sets fast pace

BOTH ENDS of the Lisbon Valley anticline in the Paradox basin are building up steam. Pure Oil Co. has staked a fourth location at Southeast Lisbon in San Miguel County, Colorado. The 10,000-ft. Devonian test, 4 Southeast Lisbon, is the first drilling north of the discovery well, and will be in 31-45n-19w. The discovery well is in 5-44n-19w.

The No. 4 is about 1 mile northwest of the discovery and nearly 3 miles northwest of No. 3 in 16-44n-19w which is shut in after flowing gas at the daily rate of 6,350 M.c.f.d. and 70 bbl. condensate in 15 minutes from Mississippian at 9,054-62 ft. The two initial wells at Southeast Lisbon are shut in after finding both Mississippian and Devonian production.

In Utah. Pubco Petroleum Co. gaged 6,078 M.c.f.d. after 45 minutes of a test in the Mississippian at 1 Lisbon - Federal in 12-30s-24e, San Juan County.

Test was at 8,388-8,507 ft. Coring continues below 8,535 at this well, 2¼ miles southeast of the Lisbon Devonian discovery well. Apache Drilling Co. is drilling at 8,840 ft. in Mississippian at 1 Federal in 9-30s-24e; Belco Petroleum has perforated a second McCracken Devonian zone at 8,990-9,004 ft. at 2 Belco-State in 16-30s-24e. This well is about 1 mile southwest of the field discovery well (see highlight page, p. 151).



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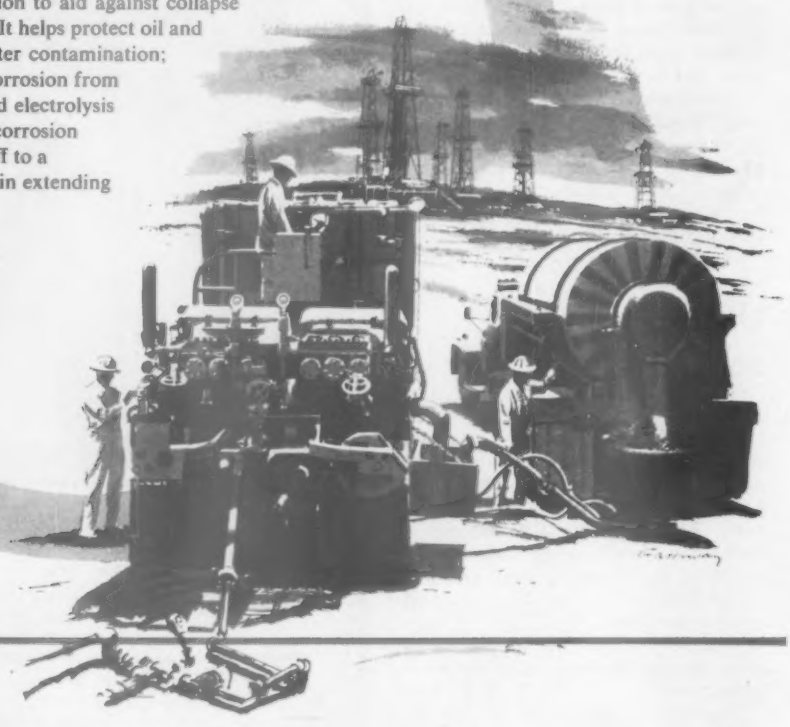

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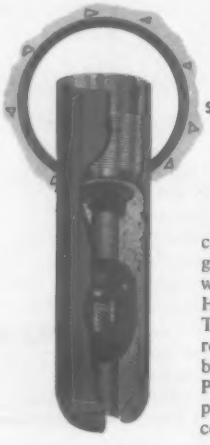

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Because the landing of the first joints of casing on bottom to be cemented may be hazardous, it is safer to install a Halliburton Cement Guide Shoe on the first joint. The strong, durable, rounded Guide directs the casing away from ledges to help prevent side-wall caving, safely passing hard shoulders, and through crooked holes.

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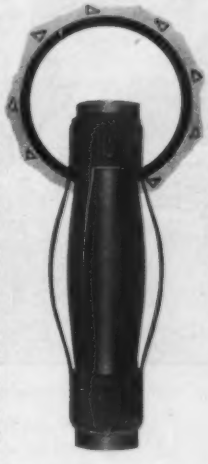

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TWENTY-ONE GEOLOGISTS have been busy with surface-mapping operations during the past 3 months in the Arctic Islands off northern Canada's shore.

Drilling is next step for Far North islands

THERE'S a very large difference between 40,800,000 and 130,000,000 acres. The 40,800,000 acres is the acreage now held under exploration permit in the Arctic Islands of far northern Canada by oil and gas companies. The 130,000,000 was the amount applied for before the issuing of new regulations by the Dominion Government of Canada on exploration and leasing of rights in the same region.

Arctic Island petroleum and natural-gas rights now held by about 25 separate companies or groups of companies represent a much truer picture of the potential oil-hunting grounds in the region than the sum applied for under priority application system up to the end of February of this year. Many millions of acres applied for in the early stampede for lands in the Arctic were highly unsuitable for oil exploration. This could be because they were over deep channels in many cases, or on the edge of the actual sedimentary-basin area. Therefore, after a closer look, highly favorable regulations or not, they would have been dropped by applicants. As of August 10, 1960, 812 separate permits have been taken out on a total of 40,820,042 acres.

Drilling next year? Twenty-one geologists have been engaged in surface-mapping operations during the past 3 months. As another oil-exploration season quickly draws to a close, companies that backed geological exploration this year are anxiously awaiting first-hand reports on their scientists' findings. It is much too early to say definitely that actual drilling operations will get underway in the late summer or fall of 1961, but this could easily be the case.

Round Valley Oil Co., a major land holder in the area and one that selected its acreage very carefully, not only taking into account geological information, but also accessibility, is extremely hot on a number of its obvious structures. And, if a working group of 5 to 10 companies can be formed to foot the bill on movement of rotary-drilling equipment to the region of the Midnight Sun, at least one contractor is prepared to test the rigors of northern operations within the next 12 to 14 months. The price tag on 1 year's drilling operations that could result in completion of from one to six wells, depending on depth and many other unknown factors, could run around the $2,000,000 mark.

Big gamble? It would be a big gamble to head into the Arctic Islands with drilling equipment this early in the game. But on the basis of available information—geological and airphoto work—the possibilities appear to make the gamble very worthwhile. From the air the Arctic Islands themselves look exactly like the North African desert, or Persia. Learned oil men that have had occasion to see both areas from many vantage points claim there is a startling similarity in the two regions—excluding, of course, the ever-present ice flows in the Arctic Ocean. Some of the mapped surface structures have also been compared in size and closure to the huge Kuwait field. Only the drill bit can tell all the needed answers and thus drilling next year just may come about.

Oklahoma's Grady has important find

OKLAHOMA has one of its most important discoveries of the year at a wildcat in Grady County. Cleary Petroleum Co. et al. 1 Hilltop, 16-8n-5w, opened Bromide Ordovician gas-condensate production near Middleburg in southwestern Oklahoma.

The well flowed 31 M.M.c.f.d. and 10 bbl. of condensate from perforations at 11,708-71 ft. Other possible pays include the Hunton Siluro-De-

vonian and Osborne sand. This pool opener is first production for the township. Nearest oil is to the east in McClain County's Freeny area, 10 miles. Nearest Bromide production is 30 miles north at El Reno and 16 miles south at Northeast Bradley field. Test is on a farmout of 2,300 acres obtained from Mobil while Pan American supports. Holding interest with Cleary are Calvert, Eason, Fleet, and Osborn. Brooks Hall, Union Oil Co. of California, and Humble hold representation in the area where Pan Am has a strong position.

Other strikes. The entire state of Oklahoma is enjoying a brisk exploratory period this summer.

In Alfalfa County on the north side of the state, Shell Oil Co. added prolific gas production to the Vining area. The 1-14 Johnson, C NE SW 14-27n-9w, flowed 36 M.M.c.f.d. from Cherokee Pennsylvanian sand through perforations at 5,285-5,310 ft. There were also 28 bbl. condensate per million at the well. Woods Petroleum Co. 2 Wokaty in C NE SW 16-28n-9w, Mendon field, flowed 5 M.M.c.f.d. through 20/64-in. choke from 5,000-3 ft.

Beaver County. Oklahoma Natural Gas Co. 1 Robertson, NE NE SW 16-2n-28eCM, a new Morrow Pennsylvanian discovery for the Panhandle, flowed 6 M.M.c.f.d. and condensate from 7,624-7,708 ft. Carter Division of Humble Oil & Refining Co. 2 Storey, NW NW 35-1n-20eCM, a Dover field well, swabbed 952 bbl. of oil per day from Morrow perforations at 7,386-7,424 ft.

Blaine County. Sunray Mid-Continent Oil Co. found oil at Squaw Creek at the 1 Baker-B in C SE NW 1-13n-13w. The well flowed 208 bbl. of oil from Cherokee Pennsylvanian at 10,717-40 ft. The discovery well in this field had gas-condensate production. The east offset had Morrow gas production.

Bryan County. In southern Oklahoma, Sinclair Oil & Gas Co. has the third well at East Durant field. The 1 Anderson-Mayhue, NW SE SE 34-6s-9e, flowed 1,538 M.c.f.d. from Bromide at 7,072-7,210 ft. From McLish Ordovician at 7,735-92 ft. it flowed 2,470 M.c.f.d.

Caddo County. Another busy Sooner area is at Apache. J. M. Huber Corp. 3 Geonety, NE NW NW 12-5n-12w, flowed 55 M.M.c.f.d. from Viola Ordovician at 2,312-2,588 ft.

Canadian County. Cities Service Oil Co. opened Cottage Grove Pennsylvanian production 1 mile west of Ordovician production at Fort Reno field. The 1 Fitzgerald, C SW NE 6-12n-8e, flowed 162 bbl. of oil in 18 hours through ½-in. choke.

Coal County. This southeastern sector is back in the news with Tennessee Gas Transmission Co. finding 40 bbl. per hour at 1 Hudson in C NE NW 7-1n-10e in the McLish sand. This is near the prolific Oconee field area in the McAlester basin.

Custer County. Mobil Oil Co. has new Oswego Pennsylvanian production at 1 Horton, 7 miles east of Hunton production. The well flowed 2,300 M.c.f.d. and 10 bbl. oil per hour during tests.

Dewey County. Amerada Petroleum Corp. 1 Flag is a Morrow well for the Lenora area. The well flowed 7,600 M.c.f.d. from perforations at 10,371-10,485 ft.

Ellis County. There are two new pools in this county, both Pan American Petroleum Corp. discoveries. The 1 Wilson, C NW SE 35-22n-26w, between West Shattuck and North Linscott fields, flowed 2,740 M.c.f.d. from Morrow at 9,344-48 ft. The 1 State-K, C NW SE 33-21n-24w, east

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of East Shattuck field, flowed 1,245 M.c.f.d. from Morrow at 9,640-44 ft.

Kingfisher County. This west-central area continues its lead over other Oklahoma newsmakers. Recent developments include Eason Oil Co.'s 2 Petru in C SW NW 21-19n-6w, East Hennessey field well. It flowed 50 bbl. hourly from open hole at 6,922-80 ft. in the Meramec Mississippian. From Manning at 6,602-6,736 ft. it flowed 20 bbl. per hour on 18/64-in. choke.

King-Stevenson opened Red Fork Pennsylvanian pay at 1 Pacula in C NE SW 14-19n-6w on the east side. This one flowed 336 bbl. of oil per day from perforations at 6,418-22 ft. Meramec was good for 451 bbl. per day. Cabeen Exploration Co. has gas-condensate production at 1 Reiswig, C NE NW 21-19n-7w. Texaco Inc. continues to expand operations at the Oswego pool in Southeast Lincoln field.

Lincoln County. This busy Central Oklahoma county saw good gas discoveries. Powel Briscoe 1 Breeding, an old well worked over in NE NE NE 26-16n-2e, flowed 10 M.M.c.f.d. from Cleveland sand at 3,914-18 and 3,924-26 ft. Open flow for the day is 26,300 M.c.f.d. The 1 Drake in C SW 24-16n-2e flowed 30,000 M.c.f.d. from 3,864-76 ft. New locations are announced for this new area.

Love County. Texaco Inc. 1 Sadler in NE SE NE 13-7s-2e, Enville area in the southern extreme of the state, flowed 57 M.M.c.f.d. and 6,100 bbl. condensate per day from Oil Creek Ordovician sand at 11,012-22 ft. This is one of the biggest wells in this area.

Major County. In northwestern Oklahoma, Pan American 1-A is a new Chester Mississippian discovery for the Reames farm in C NW SE 29-20n-11w, southwest of Ringwood field. The well flowed 7,116 M.c.f.d. from perforations at 7,378-90 ft. At Cheyenne Valley, a prolific Cherokee producer, flow of 224 bbl. per day is reported at Shell 2-7 Brewer, C SW NE 7-21n-14w.

McClain County. Brook Hall and Gordon Street have a dual discovery at 1 Allison in C NW SW 8-7n-4w, northwest of North Dibble field. The well flowed 86 bbl. of oil per day on 14/64-in. choke. The Hart sand was good for 62 bbl. per day at 9,410-16 and 9,530-42 ft.

At Southwest Goldsby, Sinclair 1 Ward, an old rework well, flowed 331 bbl. of oil in 12 hours from perforations in the Deese Pennsylvanian at 8,215-8,302 ft. plus 2,467 M.c.f.d. Southwest Wayne field was moved 1 mile east at Ambassador Oil Corp. 1 Welch in C NE SE 13-5n-2w. This Hart sand well flowed 283 bbl. of oil in 7 hours from 6,647-70 ft.

Good Arbuckle production found in Kansas field

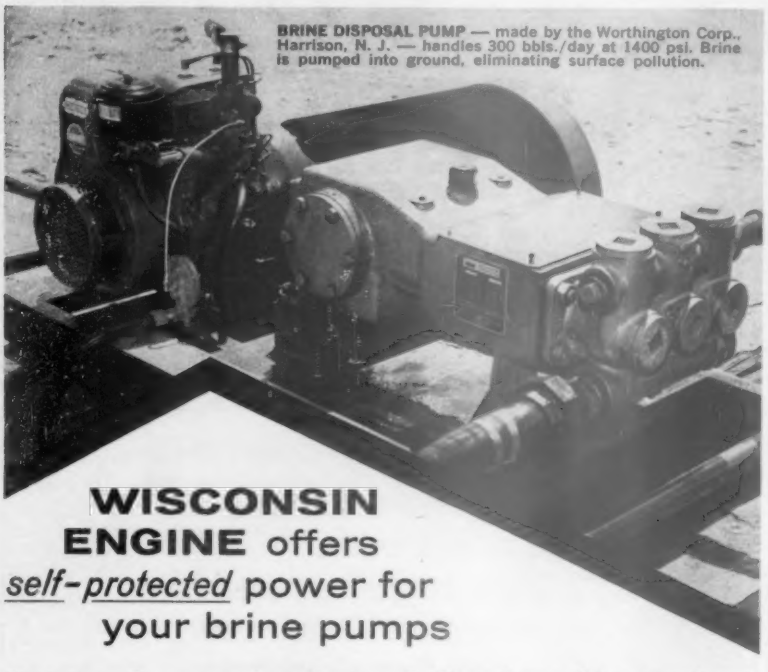
A good Arbuckle Cambro-Ordovician producer was added to Farmington field in Stafford County, Kansas. The well is Wilkinson Drilling Co. 1 Carpenter on the east side of the field in SW SE SW 25-24s-15w. Initial pump rate was 232 bbl. per day from open hole at 4,340-95 ft.

Michigan wildcat taps oil pay

Bell and Gault Drilling Co.'s 1 Young, NE NE NW 11-8s-1w, Wright Township, Hillsdale County, Michigan, a wildcat located 15 miles southeast of the Scipio-Albion-trend production, drilled oil pay at 3,458-66 in the Prairie du Chien sandy dolomite Cambro-Ordovician.

The test carried 1,250 ft. of oil in 24 hours and flowed 60 bbl. oil while 7-in. casing was being run to top of pay.

The outpost, located only 6 miles north of the Ohio State line, had



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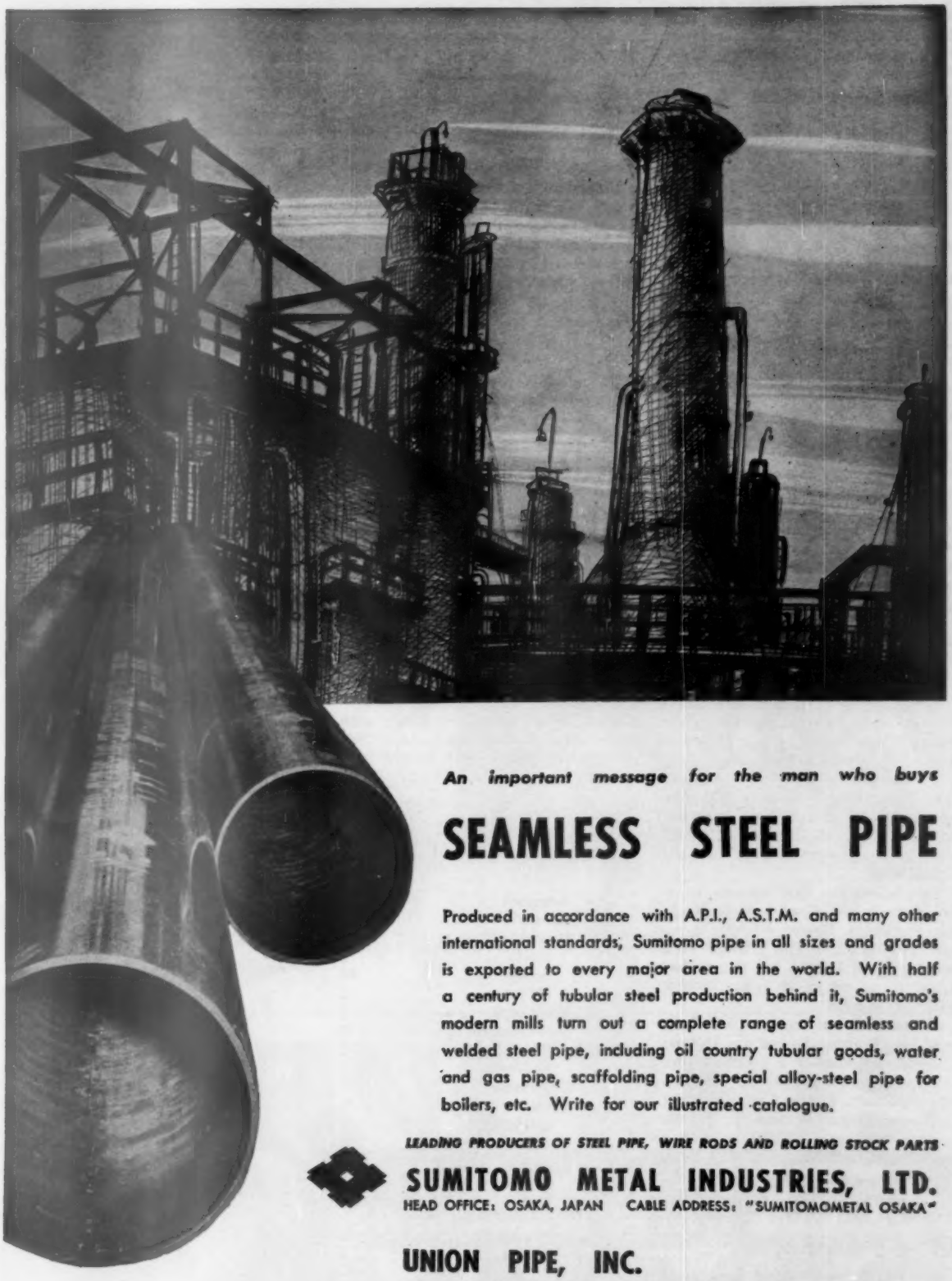

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missed both dolomite and pay in the Trenton and Black River sections, chief producing horizons of the Scipio-Albion-trend field. Trenton had been logged at 2,856 and base of the Black River at 3,435 ft.

The strike stirred considerable interest. At least one other offtrend location in the Pulaski field, Jackson County, completed in the same horizon last year for a 20-bbl. producer.

Panhandle well probes shallow Tubb Permian

The shallow Tubb Permian sand may join the Red Cave as the new exploratory target in the Texas Panhandle.

Amarillo Oil Co. 3R Deahl "B," Carson County well inside old Panhandle field, flowed an estimated 3 M.M.c.f.d. during tests of perforations from 1,437-1,503 ft. Location is in Section 5, Block 5, B&B Survey, 15 miles northwest of Panhandle. With this success and the recent growth of Red Cave exploration in the Panhandle, there may be a drilling spree in the shallow Permian gas rocks above the regular Hugoton-Panhandle field pay in the making.

Ohio's Muskingum has twin producers

In Ohio, two good producers about ¾ mile apart were completed in the Flint Ridge oil play in Hopewell Township, Muskingum County.

Preston Oil Co. 3 J. R. Varner, Section 3, reported a flow of 392 bbl. of oil per day in a 24-hour test after fracture. The well had 400 ft. of oil natural from the Clinton sand at 3,226-70 ft.

In a 3-hour test after fracture, Hartley, Grumbell & Reed 4 A. C. Boehler, Section 3, flowed 60 bbl. of oil and 197 M.c.f.d. The Clinton sand was logged at 3,295-3,342 ft. and had 1,000 ft. of oil in 16 hours natural with 15 M.c.f.d.

A southern extension to Moreland pool in Prairie Township, Holmes County, resulted in a 150-bbl. producer that also gaged 979 M.c.f.d. after fracture. H. D. Collins stepout 2 Thomas Dague, Section 28, had the Clinton sand at 3,253-70 ft. with a show of oil and 200 M.c.f.d. natural.

Eighth success for Ohio's Coshocton

IN OHIO, Roy Weed announced the eighth success on the M. W. C. district tract, Lot 9, second quarter, Newcastle Township, Coshocton County. The well made 125 bbl. of oil and an estimated 400 M.c.f.d. of gas in a 24-hour test after fracture. This addition to Newcastle field had a showing of oil and gas from the Clinton sand at 2,850-77 ft. and 2,888-2,912 ft.

● In Clayton pool, southeast Madison Township, Perry County, Commonwealth Petroleum Co. reported the 3 Friel Realty Co., Section 33, tested 3,380 M.c.f.d. of gas and 5 bbl. of oil 4 days after fracture. The Clinton sand was logged at 3,340-82 ft. and had 1,100 M.c.f.d. natural with 600-psi. rock pressure.

Wyoming's Patrick Draw sets fast pace

The busiest area in the Rockies is still Wyoming's Patrick Draw area in the Green River basin. Four completions and two new locations were announced last week for the Sweetwater County area.

Forest Oil Corp. and Union Pacific Railroad completed 10-A Arch unit 13-3 flowing 1,100 bbl. of oil per day through 32/64-in. choke from Almond Cretaceous perforations at 4,726-54 ft. This is almost as high as the best gage yet in this field at the 4 Unit—it made 1,122 bbl. per day. The 10-A well is the northwesternmost on the Arch trend..

At Beason Ridge unit, the center of the Almond trend running through Patrick Draw, Beacon Ridge, and Arch units, Texaco Inc. added two more wells. The 7 Unit flowed 946 bbl. in 17 hours. The 8 Beacon Ridge unit flowed 573 bbl. per day through 24/64-in. choke.

New drilling is planned on the northwest side of Beacon Ridge by Colorado Oil & Gas Co. They will drill 1-26 Government. There are 16 producers in the Beacon Ridge unit.

At Patrick Draw unit on the south end of the big trend, El Paso Natural Gas Products Co. began its fortieth well. This infield location is drilling below 2,188 ft. El Paso has done all the drilling at Patrick Draw except for one dry hole drilled by Gulf at the southwest end of production. That Gulf well and one El Paso failure in 13-18n-99w are the only mars on this prolific trend. The Almond producing trend now stretches with no breaks for more than 7 miles northwest-southeast. It is 3 miles wide at the widest place on the north side of Patrick Draw. There are yet no indications of how far production will go north, west, or northwest. Field limits may be marked by dry holes on the east and southeast, however.

Another oil well finaled in N. W. Oklahoma field

Northeast Cheyenne Valley field in Major County, northwestern Oklahoma, added another good well last week at Shell Oil Co. 3-8 Brewer "E," C SW NW 8-21n-14w.

The well flowed 174 bbl. of oil in 16 hours on 14/64-in. choke from Cherokee Pennsylvanian perforations at 7,125-74 ft.

Cleveland County. In Central Okla-

August Multiple Completions

	Dual	Triple	Quadruple
Arkansas	1	1	..
Kansas	12	2	..
Louisiana	31	2	..
North	2	..	..
South	16	..	..
Offshore	13	2	..
Mississippi	1	..	..
New Mexico	9	..	..
West	5	..	..
East	4	..	..
Oklahoma	17	3	..
Texas	72	9	1
District 1	2	..	..
District 2	9	1	..
District 3	15	2	..
District 4	11	1	1
East	10	2	..
District 7-B	2	..	..
West	18	3	..
District 10	5	..	..
Total U. S.	**143**	**17**	**1**

homa, Petroleum Inc. completed a Wilcox Ordovician oil discovery at 1 Crowder in C NE NE 14-9n-3w, 1½ miles northeast of West Norman field.

The well flowed 240 bbl. of oil daily through 18/64-in. choke from second Wilcox sand perforations at 9,634-44 ft.

Lincoln County. A Lincoln County gas pool was confirmed, giving this Central Oklahoma county new gas production.

Powel Briscoe Inc. completed 1 Drake in C SW 24-16n-2e flowing 30 M.M.c.f.d. from Cleveland Pennsylvanian sand at 3,864-76 ft. The discovery well of the field is 1 Breeding in NE NE NE 26. That well flowed 26,300 M.c.f.d. from 3,914-18 and 3,924-26 ft.

Discovery Wells

WESTERN CANADA

Alberta:

Peers. Mobil 10-20 Peers, LSD 10, 20-53-12w5. IPF 577 bbl. on 4-day test. Cardium 4,919-21 ft. TD 4,990 ft. Cardium oil well.

Cold Lake. Ranger 10-30 Cold Lake, LSD 10, 30-62-1w4. IPF 1,000 M.c.f.d., Colony 1,014-34 ft. TD 1,316 ft. Gas discovery.

Crossfield. Pan American-Fargo G-1 16-14 Crossfield, LSD 16, 14-28-1w5. IPF 10 M.M.c.f.d., Elkton 7,570-7,632 ft. TD ? Still drilling.

Hussar. CPOG+ 6-18 West Hussar, LSD 6, 18-27-20w4. IP 2,500 M.c.f.d., Basal Colorado 4,134-40 ft. TD 4,650 ft. Gas discovery.

Knappen. Home Pacific 16-29 Knappen, LSD 16, 29-1-11w4. IP 4,500 M.c.f.d., Mississippian 2,712-35 ft. TD Drilling. IPF from Basal Cretaceous 2,410-2,620 ft. was 3,749 M.c.f.d. From Sawtooth at 2,620-60 ft. it was 2,100 M.c.f.d.

MICHIGAN

Macomb County:

Panhandle Eastern Pipe Line Co. 1 Holmes, SE SW SW 32-4n-14e, Lenox Township, 5 miles north Chesterfield gas pool. IP 2,800 M.c.f.d. Elev. 651 ft., A-1 Salina 2,733 ft., gas 2,740 ft. TD 3,020 ft. New gas pool.

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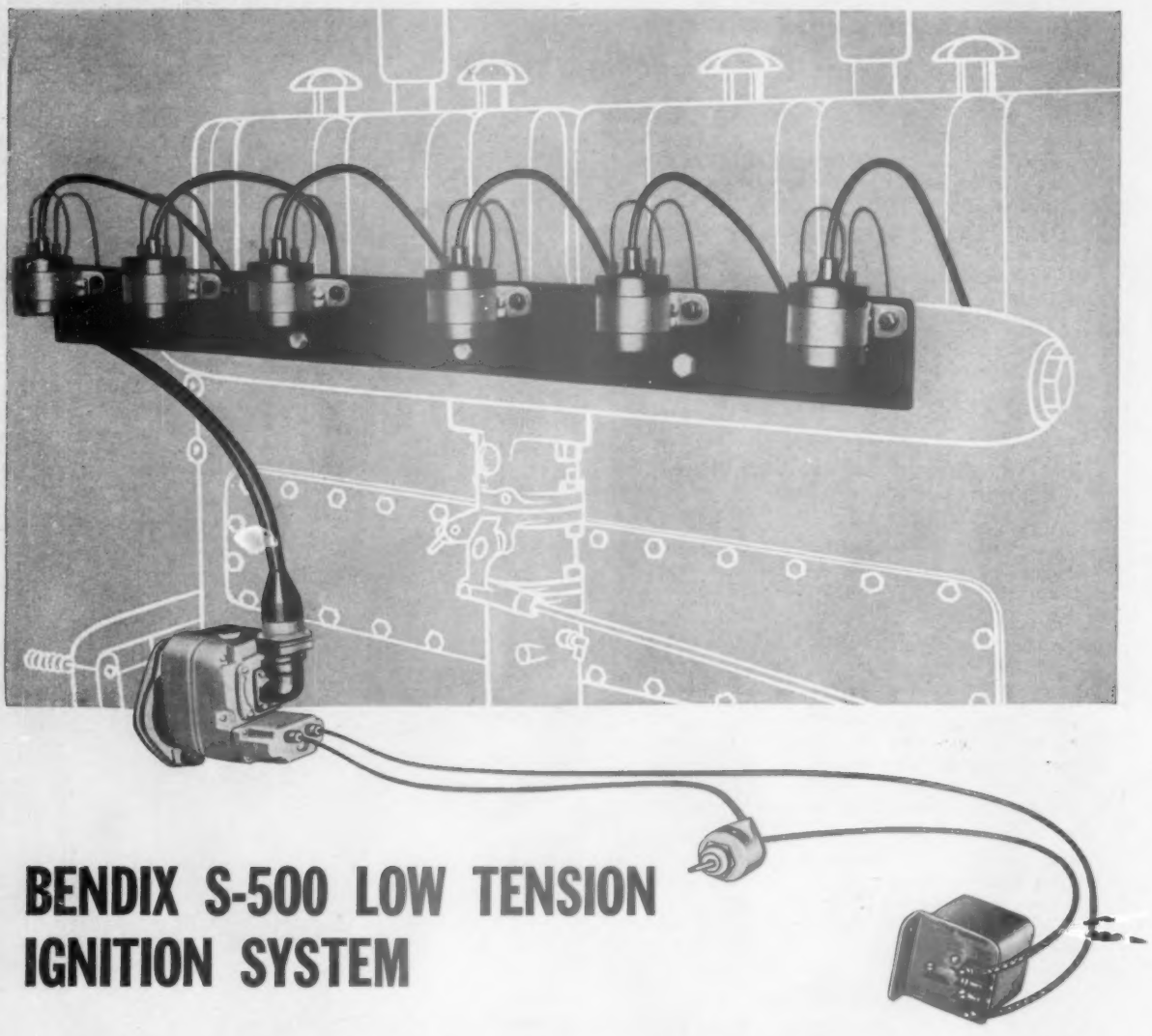

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Wheless Gets the Top Post

. . . in Louisiana-Arkansas division of Mid-Continent. He is a drilling contractor with a chemical background.

THE Louisiana-Arkansas Division of the Mid-Continent Oil and Gas Association has chosen a 44-year-old drilling contractor to head the organization for the coming year.

N. H. (Nick) Wheless, Jr., president of Wheless Drilling Co., Shreveport, is stepping into the job held for the past 2 years by Shell Oil's Vice President Bouwe Dykstra, New Orleans.

Wheless last week begged off from describing the course he will chart for the association during his tenure as president.

"First I want to get acquainted with the job," he said.

Despite his current reticence, Nick Wheless is expected to have plenty to say in the year ahead. As head of a drilling company that has, like others, felt the sting of the current drilling recession, he will speak from experience in pinpointing industry ailments.

"As long as prices are low, and allowables are low, there's just not the money available to drill the wells," he said.

N. H. Wheless, Jr.
. . . Chemist turned contractor.

His company . . . As drilling contractors go, Wheless' company is a real oldtimer.

It was founded in 1924 as the old Sultana Drilling Co. by Wheless' father, N. H. (Hobson) Wheless, Sr., at Shreveport. The Smackover field in Arkansas gave Sultana its first impetus and kept four rigs busy.

After a couple of name changes during the 1940's it emerged as the Wheless Drilling Co., and Nick Wheless moved into the presidency in 1956. The elder Wheless is chairman of the board.

It operates 14 rigs today in the Louisiana Gulf Coast, South Arkansas, East Texas and North Louisiana. Of the 14, nine are on inland barges.

His past . . . Except for schooling and military service, Nick Wheless has lived in Shreveport all his life.

He attended University of the South, Sewanee, Tenn., in 1933 and 1934 and then spent 4 years at Massachusetts Institute of Technology, where he earned a chemical engineering degree.

Asked last week how he happened to study chemical engineering in preparation for a career in drilling, Wheless said the kind of engineering he studied wasn't important.

"If you study engineering, you learn thought processes—and that's the important thing," he said. "You can pick up the experience you need in any given field later."

With that philosophy, young Wheless started roughnecking for his father in 1938, became a good mud engineer, and eventually was put in charge of some of Sultana's rigs.

World War II interrupted his oil career. He enlisted in the Air Corps in March 1942 and served as a meteorologist at West Coast and southern air bases. He was discharged a captain in 1946.

He returned to the drilling firm and became vice president in 1947 and president in 1956. Also he is an official in two small producing companies, N. H. Wheless Oil Co. and WWF Oil Corp.

He has served in various assignments with the American Association of Oilwell Drilling Contractors. Last year Wheless was a member of the management and executive committees of the Mid-Continent Oil and Gas Association (Louisiana-Arkansas Division).

Other officers . . . The association, in addition to naming Wheless, re-elected 15 regional vice presidents and added two new ones—Dykstra, the retiring association president, and Kenneth H. Shaffer, new president of The California Co., New Orleans.

Charlie S. Wilkins, Baton Rouge, executive vice president and secretary-treasurer, was elected to another term.

▶▶▶ Personals

R. J. Metcalf, manager of operations at Gulf Oil Corp.'s Philadelphia refinery, has been promoted to general manager of the Cincinnati refinery. He succeeds **Paul Siecke,** who has been transferred to Gulf Eastern Co. **W. S. Bonnell,** director of the chemical processing division at the Port Arthur, Tex., refinery, will succeed Metcalf in Philadelphia.

W. W. Clark, assistant director of Continental Oil Co.'s marketing-research division in Houston, has been named special assistant to the general manager of Conoco's petrochemical department. He also will serve as assistant to the chairman of Carlon Products, Inc., an affiliate. Clark will headquarter in Aurora, Ohio.

Robert S. Armstrong, lube-plant process foreman at the Lima, Ohio, refinery of Standard Oil Co. (Ohio), has been named industrial engineer in the company's No. 2 Cleveland refinery.

H. G. Dillin, executive vice president of San Diego Gas & Electric Co., San Diego, Calif., has been nominated for president of the Pacific Coast Gas Association. **W. T. Lucking,** president of Arizona Public Service Co., is currently president of the association. Election of new officers will be held at PCGA's annual meeting September 23. Others nominated for office are **William J. Bailey,** Day and Night & Payne Co., La Puente, Calif., for first vice president; **S. L. Sibley,** Pacific Gas & Electric Co., San Francisco, for second vice president; and **L. W. (Ted) Coughlan,** Pacific Gas & Electric, San Francisco, for treasurer. Nominees for director include **Lloyd Cooper,** California-Pacific Utilities Co., San Francisco; **O. Marshall Jones,** Cascade Natural Gas Co., Seattle; **Ralph Gibson,** Intermountain Gas Co., Boise, Idaho; **W. T. Nightingale,** Mountain Fuel Supply Co., Salt Lake City; **B. T. Poor,** Washington Natural Gas Co., Seattle; **Walter S. Lee,** Major Controls Co., Corona, Calif.; and **H. A. Proctor,** Southern California Gas Co., Los Angeles.

Griffiths | Ikard | Cox | Corkill | Seaman | Barbee

Northern Natural Revamps Operations

In an extensive reorganization of operations, Northern Natural Gas Co. has appointed area managers for new offices in Minneapolis; Des Moines; Lincoln, Neb.; Great Bend and Liberal, Kans.; and Midland, Tex.

The six managers are: Evan M. Griffiths, Des Moines; Carl W. Ikard, Liberal; Ross N. Cox, Lincoln; David P. Corkill, Minneapolis; Jack W. Seaman, Midland; and Otto V. Barbee, Great Bend.

The managers will report to A. L. Vaughan, Omaha, who was named vice president of the new operating division last week (OGJ, Sept. 12, p. 181). Glen Grove, manager of administrative control, will coordinate area activities.

Northern's Midland office has been operating on the area-control plan for 18 months in an effort to test the decentralization setup.

The reorganization, according to Vaughan, is intended "to achieve closer control of a transmission system which has grown too large for effective direction from one central office."

Area offices will be responsible for all regular plant and pipeline operations in their territory and for maintaining an adequate gas supply on their part of the transmission system.

An administrative coordinator, personnel administrator, and technical coordinator will be appointed to the staff of each area manager.

C. J. van der Werff has been named administrative assistant to the director of exploration and production in Caracas for Shell de Venezuela. He replaces **E. A. Moore,** who has been transferred to Canada.

Wayne H. Dean has resigned as executive vice president and a director of Zapata Off-Shore Co. Dean has acquired Zapata's interest in Perforaciones Marinas Del Golfo, S.A. (Permargo) and will devote full time to this company. Permargo was organized to operate a drilling rig for Pauley interests in Mexico. In Zapata appointments, **Ian Figart,** vice president, will be in charge of drilling operations. **G. H. Walker, Jr.,** managing partner of G. H. Walker & Co., New York, has been elected a director of Zapata.

C. P. Necessary, tool pusher with Falcon Seaboard Drilling Co. in Clinton, Okla., has been promoted to drilling superintendent in Oklahoma City.

Dr. Roger E. Hatton, group leader in the research department of Monsanto Chemical Co.'s organic chemicals division, has been appointed a development department project manager for petroleum chemicals and functional fluids. He will headquarter in St. Louis. **Dr. Kenneth L. McHugh,** research group leader for Monsanto's research and engineering division in Everett, Mass., has been transferred to St. Louis as research group leader in the organic chemicals division sales department in St. Louis. **Donald E. Colombo** has joined the technical service department of the plastics division in Springfield, Mass.

John McVean Luard, general manager for exploration in the British Petroleum group's headquarters office, London, has been elected a director of BP Exploration Co., Ltd. **John Moffat,** general manager for refining in the London home office, has been elected a director of BP refinery (Llandarcy) Ltd., BP Refinery (Kent) Ltd., and BP Refinery (Grangemouth) Ltd.

William H. Elias, assistant chief geophysicist for Richfield Oil Corp.'s Canadian division, has been promoted to chief geophysicist in the division. He succeeds **Donald Grinsfelder,** who has been transferred to Long Beach, Calif. Elias will continue to headquarter in Calgary.

Dan B. McVickar and **Bernard L. Meyers** have joined the research staff of the Whiting, Ind., laboratories of Standard Oil Co. (Ind.). McVickar will work with antiknock research and Meyers with X-ray analysis.

H. R. Sontag has been named plant manager for Goodyear Tire & Rubber Co.'s new Beaumont, Tex., chemical plant. The plant, now under construction, will produce polybutadiene and polyisoprene synthetic rubbers. It is scheduled for completion late next year. **F. L. Barga** has been named personnel manager of the plant. Sontag was production superintendent of Goodyear's Houston synthetic rubber plant at one time and later handled a special assignment as leader of a group assisting in start up of an English synthetic plant. He has been with Goodyear since 1941.

Dr. Harry A. Wistrich has been named a supervisor in the chemical-separation department of Shell Development Co.'s Emeryville, Calif., research center. **Dr. Bruce N. Bastian** has joined Shell in Emeryville as chemist in the organic-chemistry department.

R. H. Harvey has been named manager of the coordination division in the coordination and petroleum economics department of Standard Oil Co. (N. J.). He had been assistant head of the petroleum products division at the Baton Rouge refinery of Humble Oil & Refining Co. **Robert Ihrie,** head of the business-analysis department in Baton Rouge, has been appointed head of the foreign-industry section in Jersey Standard's petroleum - economics division, coordination and petroleum-economics department.

J. A. Armstrong, assistant manager of the western producing region of Imperial Oil Ltd., has been appointed general manager of the producing department. He succeeds **Vernon Taylor,** a director and vice president, who will devote full time to corporate policy matters. Armstrong joined Imperial in 1940. He had been assistant western manager since 1955.

Robert A. Mittelstaedt has been named superintendent of gas control for East Ohio Gas Co. He succeeds **William J. Giblin,** who has retired.

H. W. Selman, compressor station engineer for United Gas Pipe Line Co. in the Shreveport, La., district, has been transferred to the Latex, Tex., station from Rodessa, La. **Wray G. Hoffpauir,** crew foreman in Sterlington, La., has been named section foreman in the Houston district pipeline department. He will headquarter in Refugio, Tex.

Robert James Fierheller has joined Union Gas Co. of Canada, Ltd., as assistant to the corrosion engineer.

John Deeter, engineer at Sohio Pipe Line Co.'s Stoy, Ill., pumping station, has been named foreman there.

Don L. Weinert, formerly with Okan Pipeline Co., has joined Mid-America Pipeline Co. as products-movement supervisor. He will headquarter in Tulsa.

Mason L. Hill, Richfield Oil Corp., Los Angeles, and **Harold T. Morley,** Pan American Petroleum Corp., Tulsa, have been nominated for 1961 president of American Association of Petroleum Geologists. Others nominated

HILL

MORLEY

for AAPG offices are, for vice president, **J. Ben Carsey,** Humble Oil & Refining Co., Houston; **Ralph W. Edie,** Calgary consultant; and **William Hilseweck,** Dallas consultant; for secretary-treasurer, **George V. Cohee,** U. S. Geological Survey, Washington; and for editor, **Grover E. Murray,** Louisiana State University, Baton Rouge. Election will be by mail ballot and officers will be installed April 27 during the association's annual meeting in Denver. **Ben H. Parker,** Frontier Refining Co., Denver, is current AAPG president.

Louis N. Carmouche, manager of Dow Chemical Co.'s Ludington, Mich., division, has been appointed general manager of the Saginaw Bay division, Bay City, Mich. The division includes new petrochemicals and polyethylene plants and Bay Refining Co., acquired by Dow in 1956. **John W. Corey,** director of Dow's research and development laboratory at Ludington, will succeed Carmouche there.

Joseph T. Froehlich, general manager of the foreign operations department (Eastern Hemisphere) of Texaco Inc., has been appointed general manager of Texaco Trinidad, Inc., at Pointe-a-Pierre. **James A. Hulme,** Texaco Trinidad general manager, has moved to New York to succeed Froehlich.

Frank J. Garnett, assistant manager in New Orleans for Reading & Bates, Inc., has been transferred to Jackson, Miss., as area manager. The drilling company has closed its New Orleans office and moved headquarters for offshore operations to Houston.

C. E. Sommarstrom has been appointed chief engineer of refinery and chemical work for Canadian Bechtel, Ltd., with responsibility for the Toronto engineering office. **J. J. Cannon** has been named administrative engineer.

Charles H. Dodson, general manager of domestic sales, New York, has been named vice president in charge of operations for Texaco Inc. in Chicago. Dodson joined Texaco in 1927 as an engineer in the refining department. He will be succeeded by **John I. Mingay,** assistant general manager, marine department. **Marvin E. Lundfelt,** manager of operations in the marine department, will succeed Mingay.

S. G. Sanderson, who recently retired as vice president in charge of Gulf Oil Corp.'s Houston production department, has been named president of Stekoll Petroleum Corp., Dallas. He succeeds **Marion H. Stekoll,** founder of the company.

Edward C. Mitchell has been named assistant to the vice president, foreign operations department (Eastern Hemisphere) of Texaco Inc. He has served as assistant general sales manager for Texaco's central region in Chicago since January, after service in Africa and Latin America.

C. J. Wilhelm has been named chief of the new branch of petroleum research in the Bureau of Mines' Division of Petroleum. The new research unit combines the former branches of petroleum production, petroleum chemistry and refining, and oil shale. **Donald S. Colby** continues as chief of the branch of petroleum economics. **Virgil L. Barr** has been appointed executive assistant to **Roscoe A. Cattell,** chief of the Division of Petroleum.

▶▶▶ Personals

CLARKSON

Burton C. Clarkson, assistant manager of the Baltimore refinery of Humble Oil & Refining Co.'s Esso Standard division, has been named manager. He succeeds **Charles C. Swoope,** who will serve as a consultant until his retirement. Clarkson joined Esso at the Bayway refinery, Linden, N. J., in 1950. He was assistant head of chemical products operations at Bayway before moving to Baltimore in July.

Edward B. Harry, Jr., staff assistant with Sohio Petroleum Co. in Oklahoma City, has been promoted to manager of the production department's gas-gasoline division, Oklahoma City. He has been with the company since 1949.

John S. Macmillan, manager of the oil department of Osler, Hammond, & Nanton, Ltd., has been elected a director of Security Freehold Petroleums, Ltd.

J. Ed McHale has been promoted to manager of the crude-oil purchases and sales division of Mobil Oil Co.'s new crude-oil and gas-liquids department, Dallas. **C. Fred Carl** has moved up to supervisor of field operations for the crude-oil purchases and sales division. **E. L. Upham** will continue as manager of the gas-liquids division with **W. R. Snyder, Jr.,** as assistant manager. **Edward J. Kodicek** has been named area gas representative in Chicago. **H. L. Cliburn,** area representative in Kilgore, Tex., will move his headquarters to Shreveport October 1.

Dr. Robert F. Marschner, Standard Oil Co. (Ind.), has been named chairman-elect of American Chemical Society's division of petroleum chemistry. The appointment was announced last week at the society's fall meeting in New York.

James R. Anderson, production superintendent for San Jacinto Venezolana, C.A., in Maracaibo, has joined Decker Drilling Co. as vice president and contract representative. He will headquarter in Denver.

Dr. Raymond Wynkoop has been appointed director of the new commercial-development division in Sun Oil Co.'s research and engineering department. **Dr. Egbert M. Kipp,** assistant to the manager of product

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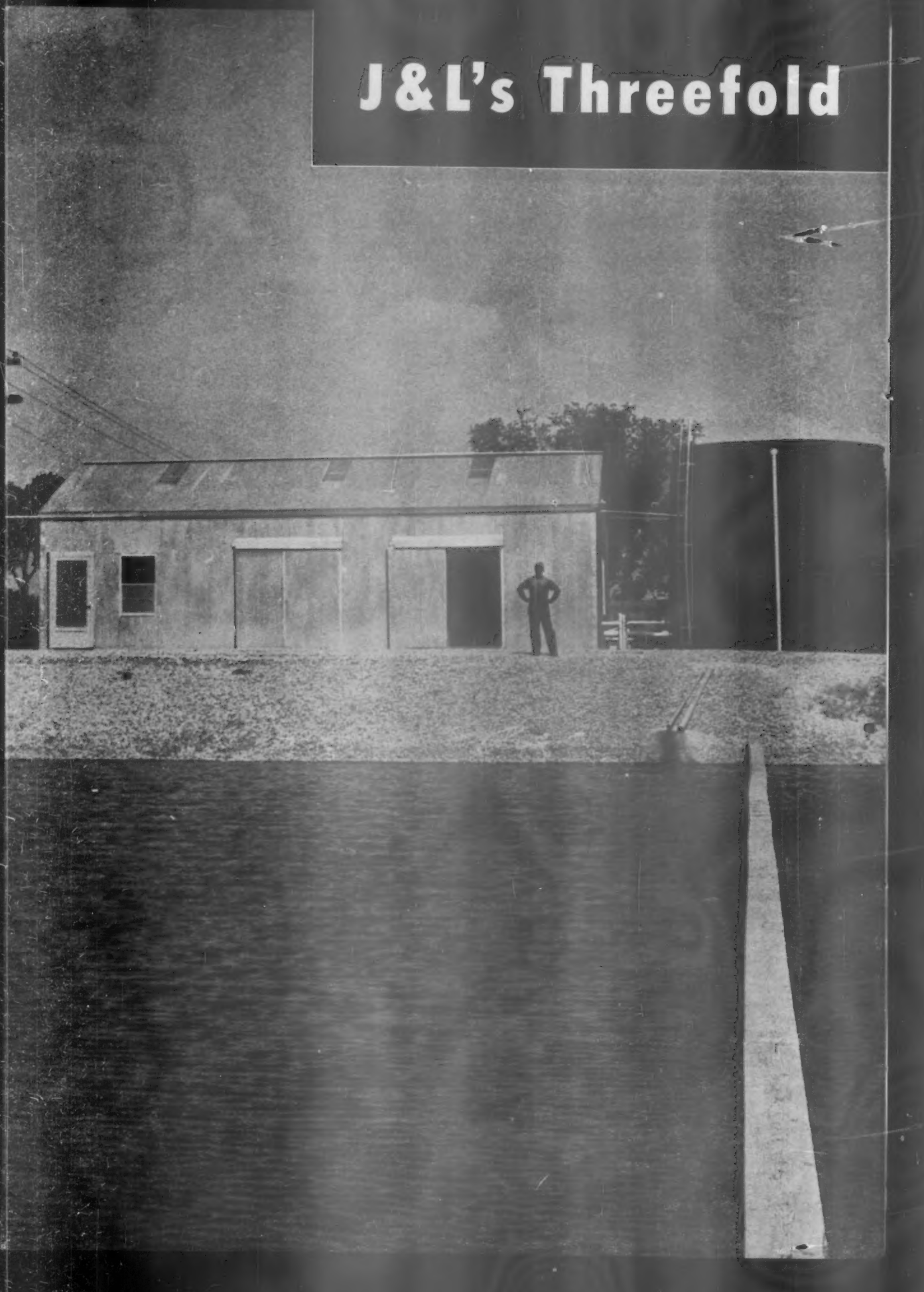

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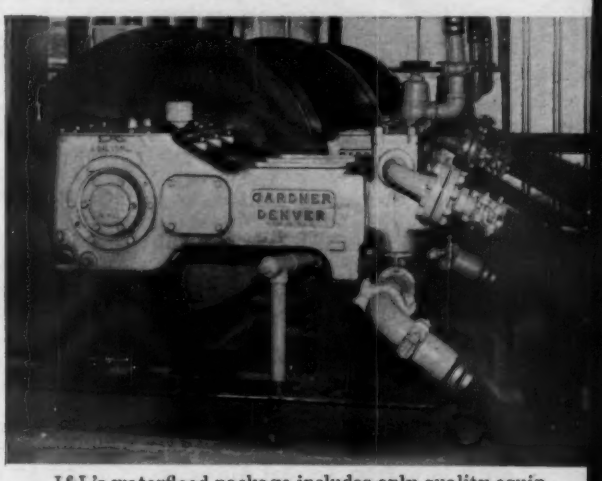

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Personals

development in research and development, will succeed Wynkoop as manager of Sun's basic research. Wynkoop was with Houdry Process Corp. and Catalytic Construction Co. before joining Sun in 1958 as assistant director, petrochemicals. Kipp joined the company last year.

Karl A. Muller, chemical engineer in the process-development laboratories of American Oil Co.'s Texas City refinery, has been promoted to senior chemical engineer. **Clifton N. Sechrist,** chemist and group leader, has been promoted to senior chemist and group leader. **Manford R. Haxton,** associate chemical engineer, group leader, has been promoted to chemical engineer, group leader, and **P. J. Naquin,** assistant chemical engineer, has been promoted to associate chemical engineer. In the Texas City plant engineering department, **Marion B. Sterling,** assistant construction and maintenance engineer, has been promoted to associate construction and maintenance engineer.

H. L. Hendry, Midland, Tex., district exploration superintendent for Sohio Petroleum Co., has been transferred to Oklahoma City as assistant land manager of Sohio's exploration department, a new position.

Wilbur S. Johnson, tool pusher with Falcon Seaboard Drilling Co., has been transferred to Stigler, Okla., from Russellville, Ark.

C. J. Livingstone, director of product application in Gulf Oil Corp.'s marketing department, has been transferred to Gulf Research & Development Co. as an associate director of research. He will be in charge of product research, development, and testing.

William J. Minges has been named associate director of Union Carbide Chemicals Co.'s engineering department.

Lawrence A. Kimpton has joined Standard Oil Co. (Ind.) as general manager of planning, a new position. It was announced in May that Kimpton, chancellor of the University of Chicago, would join the company as soon as a successor was elected by the university. Kimpton has been a director of Indiana Standard since 1958. In the new post he will supervise activity concerned with long-range planning and industry and general economics.

John A. Sherred has been named manager of market research and development in the petrochemical department of Standard Oil Co. (Ohio), succeeding the late Edward W. Sann, Jr. Sherred was development director for Monsanto Chemical Co.'s Lion Oil Co. division in Houston before joining Ohio Standard.

E. H. Burtner, assistant to the general manager, exploration, for Standard Oil Co. of Texas, has been appointed assistant to the general manager, administration. He will continue to headquarter in Houston.

George O. Relf, Jr., exploration coordinator for Gulf Oil Corp.'s domestic operations, has been elected administrative vice president and coordinator of the production department. He will move from Houston to company headquarters in Pittsburgh. Relf succeeds **Newby C. Simpson,** who has been named manager of Gulf's production operations in Libya. Relf joined Mene Grande Oil Co., Gulf affiliate in Venezuela, in 1937. He was Houston division exploration manager before being named exploration coordinator. Simpson has been domestic-production coordinator in Houston and Tulsa production division manager for Gulf. He was elected administrative vice president last year.

RELF

SIMPSON

Harlan E. Futrell, temporary development foreman for Humble Oil & Refining Co.'s Carter division in Magnolia, Ark., has been promoted to development foreman.

Eugene Jacobson has been named a vice president of Sun Chemical Corp. Jacobson is a former president of Facile Corp., which was acquired by Sun Chemical last year.

Deaths

Orrin Thacker Grove, 82, retired oil-field superintendent, died September 8 in a Tulsa hospital. Grove retired in 1948 after working with the old Prairie Oil & Gas Co., Gladys Belle Oil Co., and Jordan Petroleum Co. in Tulsa, Okmulgee, and Shawnee, Okla.

Oscar R. Burden, 74, one of the nation's leading pipeliners, died September 10 in a Tulsa hospital of a heart ailment. Burden was president of O. R. Burden Construction Corp. and its affiliates, Burden International, Ltd., Burden Drilling & Pipeline Contractors (Great Britain), Ltd., Burden Pan American, Ltd., Universal Engineers & Constructors, and was chairman of Turriff-Burden, Ltd. Burden began his 56-year career in the oil industry as a laborer and ended it as head of one of the country's best known pipeline construction firms. On the way, he served as a division manager with Texas Pipe Line Co., vice president of Panhandle Oil & Refining Co., partner in Burden-Riley Drilling Co. and B. & W. Construction Co., manager of Williams Brothers, and president of Engineers Limited Pipeline Co. A highlight in his career was his work as general superintendent of construction for three famous pipelines—the wartime Big Inch and Little Big Inch lines and Saudi Arabia's Tapline. Burden formed his own company in 1949. His companies are currently active in pipeline construction in the U. S. and Iraq and in drilling operations in Libya.

Herman P. Taubman, 68, chairman and founder of Buffalo Petroleum Corp., died September 14 in a Tulsa hospital after a brief illness. Active in civic affairs, the Tulsa oil man was known for his philanthropies. He was currently a national committeeman of the National Conference of Christians and Jews, chairman of the Tulsa Psychiatric Foundation, and a director of Hillcrest Medical Center. Taubman entered the oil business in the 1920's with Taubman Supply Co. In 1934 he set up Buffalo Oil, forerunner of the present Buffalo Petroleum. Taubman Supply was sold to Bethlehem Steel in 1936.

Claud P. Turner, 54, driller for C. T. Gates Drilling Co., Long Beach, Calif., died September 3 in Ventura, Calif.

Walter Rivers, 53, tool pusher for ACJOE Oil Drilling Co. of Manila, died recently of a heart attack while en route from New Guinea to Manila.

Daniel A. White, 69, retired production superintendent for Sunray Mid-Continent Oil Co., died September 13 in a Yale, Okla., hospital after a heart attack. White retired in 1956.

Distillate gains may range between 2% and 4% a year

BY JOHN C. CASPER

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,895,660	UP	55,320	UP	39,127
Crude stocks	232,569,000	DOWN	3,662,000	DOWN	19,379,000
Completions	961	DOWN	99	DOWN	22
Refinery runs	8,279,000	DOWN	15,000	UP	98,000
Gasoline stocks	188,886,000	UP	221,000	UP	5,395,000
Kerosine stocks	34,521,000	UP	637,000	UP	1,734,000
Distillate stocks	159,108,000	UP	6,085,000	DOWN	9,470,000
Residual stocks	47,793,000	UP	715,000	DOWN	10,985,000
Four-product stocks	430,308,000	UP	7,658,000	DOWN	13,326,000
Total imports	1,381,800	DOWN	21,500	DOWN	291,700

SALES OF DISTILLATE FUEL for heating have influenced the changing pattern of demand for petroleum products. They have been an important factor in the rate of change.

These sales of heating distillate and range oils increased 16.3% in 1946, 26.0% in 1947, and 12.7% in 1948. If the increases were smoothed out, they would represent an average annual gain of 16.6% for the 3-year period. If this rate had continued through 1959, sales of heating oils for the year would have been up to 4,590,000 bbl. daily. Actual sales amounted to a little less than 1,400,000 bbl. daily.

The shape of the curve for heating-oil sales shows that postwar gains have tended toward constant volumetric increases per year rather than constant percentage increases.

For the first 3 years of the period, annual gains in sales averaged about 37 million barrels. If this same arithmetic gain had continued through 1959, total sales for that year would have been 691 million barrels or 1,900,000 bbl. daily. This projection is still above actual sales but is much closer than the one based on constant percentage gain.

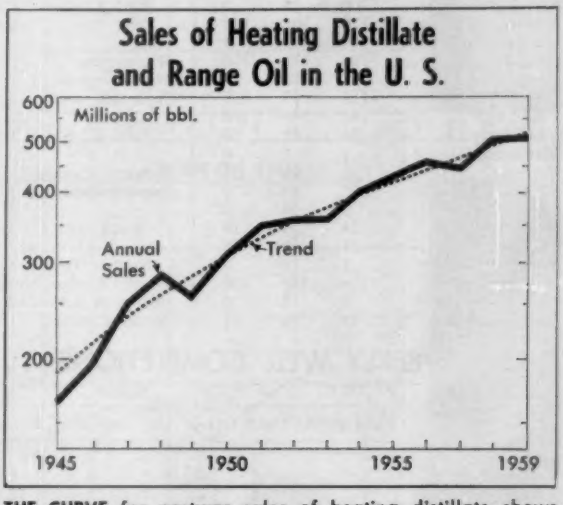
Points for actual postwar sales are plotted on semilog paper. On this scale, a straight line represents a constant percentage change. Note the definite downward curve in the trend line, indicating a gradual decrease in the annual percentage gain.

This trend in sales of heating oils tends to set the pattern for total domestic distillate demand. Since heating-distillate and range-oil sales account for about 75% of all domestic distillate demand, the curve of total distillate demand can be expected to follow the heating-oil trend.

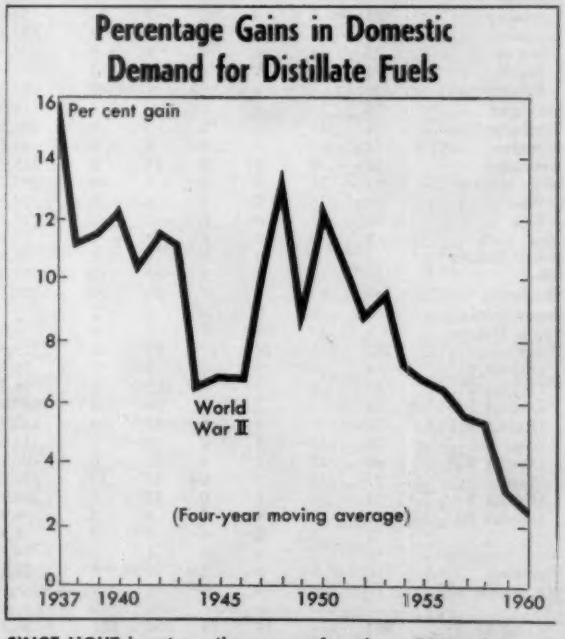
The lower chart is based on percentage gains in domestic demand for all distillate fuel for the 1937-60 period.

Points on the curve represent 4-year moving averages, plotted on the last year of each period.

The curve established the fact that there has been a definite downward trend in annual gains by distillate. Some of the big gains in the early postwar years can be credited to unsatisfied demand during the war years. This period of big gains lasted until the early fifties. However, the war influence does not explain the limited increases that have averaged about 3% a year for the past 4 years.



THE CURVE for postwar sales of heating distillate shows that the trend has been toward constant volumetric gains rather than constant percentage gains. Note downward curve in trend line . . .



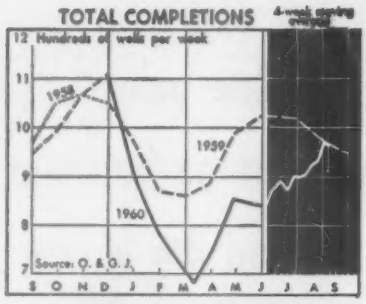
SINCE LIGHT heating oil accounts for about 75% of domestic distillate demand, the slowdown in this segment has tended to reduce the over-all percentage gain for total distillate.

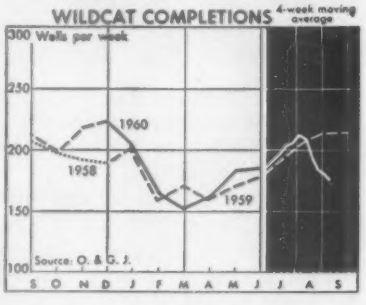
DRILLING

Active Rotary Rigs

	9-12-60	9-5-60	9-14-59
Alabama	4	4	9
Alaska	7	7	(†)
Arkansas	9	11	21
Arizona	1	0	2
California	83	76	102
Land	81	75	97
Offshore	2	1	5
Colorado	50	51	60
Florida	2	2	1
Land	2	2	1
Offshore	0	0	0
Illinois	44	35	39
Indiana	8	11	11
Iowa	0	0	2
Kansas	116	105	130
Kentucky	6	2	8
Louisiana	280	271	320
North	33	28	35
S. Inland waters	113	93	129
S. Land	80	89	106
Offshore	54	61	50
Maryland	1	1	0
Michigan	36	38	34
Mississippi	52	50	70
Missouri	2	1	0
Montana	24	26	29
Nebraska	25	19	25
Nevada	1	1	2
New Mexico	114	108	120
New York	2	1	0
North Dakota	15	14	21
Ohio	7	5	5
Oklahoma	150	163	218
Oregon	1	1	0
Pennsylvania	7	12	11
South Dakota	1	3	7
Tennessee	0	2	0
Texas	566	583	722
S. Inland waters	3	3	6
S. Land	143	164	187
Offshore	1	1	0
North	47	51	164
Panhandle	50	47	(*)
East	49	50	(*)
West Central	166	154	237
West	107	112	128
Utah	29	31	24
Washington	1	1	2
West Virginia	6	5	5
Wyoming	64	58	88
Total U. S.	1,714	1,698	2,088
Western Canada	147	149	157
Eastern Canada	1	1	1
Grand total	1,862	1,848	2,246

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.





WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 10, 1960

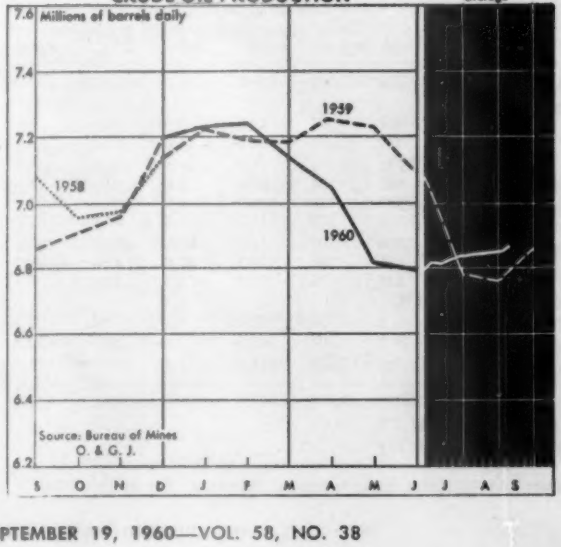
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	32	65	0	0	0	0	0	2	17
Arizona	1	0	0	0	1	0	6,260	26	.....	0	0	0	0	0	18	.....
Arkansas	8	4	0	0	4	0	31,143	410	578	1	0	0	0	1	112	100
California	17	8	0	2	7	0	76,146	1,124	1,050	5	0	0	0	5	217	266
Colorado	12	3	0	1	8	0	60,652	435	544	5	0	0	1	4	220	325
Illinois	30	16	0	1	13	0	70,501	1,533	1,569	4	1	0	0	3	312	270
Indiana	28	13	0	0	15	0	40,898	708	576	5	0	0	0	5	258	195
Kansas	113	75	0	2	33	3	261,596	2,465	2,807	14	2	0	1	11	710	679
Kentucky	55	2	0	2	7	44	54,412	1,368	1,686	0	0	0	0	0	118	169
Louisiana	70	34	7	6	23	0	542,819	2,450	2,575	11	1	2	0	8	385	346
North	27	14	0	4	9	0	104,401	916	985	6	1	0	0	5	185	148
South	31	16	3	2	10	0	293,547	1,186	1,318	3	0	0	0	3	175	184
Offshore	12	4	4	0	4	0	144,871	348	272	2	0	2	0	0	25	14
Michigan	36	12	0	0	10	14	118,043	626	448	7	0	0	0	7	163	115
Mississippi	16	11	0	0	5	0	141,580	483	434	5	0	0	0	5	183	199
Montana	12	4	0	0	8	0	63,181	214	226	5	0	0	0	5	101	71
Nebraska	22	8	0	0	14	0	125,259	617	618	7	0	0	0	7	249	259
New Mexico	34	21	0	6	7	0	187,144	1,278	1,438	2	1	0	0	1	193	168
West	16	6	0	6	4	0	74,376	429	654	2	1	0	0	1	48	45
East	18	15	0	0	3	0	112,768	849	784	0	0	0	0	0	145	123
New York	9	0	0	4	5	0	27,106	232	195	7	0	0	2	5	33	18
North Dakota	4	1	0	0	3	0	23,432	205	340	1	0	0	0	1	54	65
Ohio	50	17	0	6	10	17	128,034	734	690	1	0	0	0	1	36	23
Oklahoma	148	67	3	18	50	10	476,548	3,252	4,010	33	6	1	6	20	534	608
Pennsylvania	0	0	0	0	0	0	0	440	335	0	0	0	0	0	8	9
South Dakota	1	0	0	0	1	0	3,610	18	.....	1	0	0	0	1	7	.....
Texas	262	121	24	17	87	13	1,213,942	10,939	13,296	51	7	0	1	43	2,259	2,509
District 1	9	6	0	0	3	0	26,749	746	769	4	1	0	0	3	281	221
District 2	15	4	3	3	5	0	96,272	539	558	2	1	0	0	1	136	168
District 3	19	4	2	2	11	0	147,989	842	846	6	0	0	0	6	158	173
District 4	24	1	5	6	12	0	152,355	760	939	9	1	0	1	7	217	231
East	20	8	5	0	7	0	111,988	887	860	5	0	0	0	5	183	168
District 7-B	40	23	1	4	12	0	106,144	1,591	1,818	9	3	0	0	6	458	486
West	72	46	3	0	13	10	346,356	2,867	4,082	9	0	0	0	9	444	564
District 9	51	24	1	0	23	3	169,157	1,992	2,501	7	1	0	0	6	339	423
District 10	12	5	4	2	1	0	56,932	715	923	0	0	0	0	0	43	75
Utah	1	1	0	0	0	0	5,830	169	221	0	0	0	0	0	57	58
West Virginia	14	2	0	11	1	0	34,203	563	539	0	0	0	0	0	6	20
Wyoming	18	3	0	3	12	0	88,374	723	692	10	1	0	0	9	296	236
Miscellaneous	0	0	0	0	0	0	0	105	98	0	0	0	0	0	95	65
Total U. S.	961	423	34	79	324	101	3,780,715	31,149	35,030	175	19	3	11	142	6,626	6,790
Prev. week	1,060	432	16	94	377	141	3,873,442	.....	.....	178	11	3	7	157	.....	.....
Cum. 1960	31,149	14,178	919	2,551	11,910	1,591	131,606,751	.....	.....	6,626	584	74	220	5,748	.....	.....
Cum. 1959	35,030	17,617	857	2,564	13,092	900	145,755,775	.....	.....	6,790	641	89	217	5,843	.....	.....
Western Canada	53	31	0	9	9	4	279,276	1,623	1,719	11	2	0	4	5	429	482

DAILY AVERAGE PRODUCTION FOR WEEK

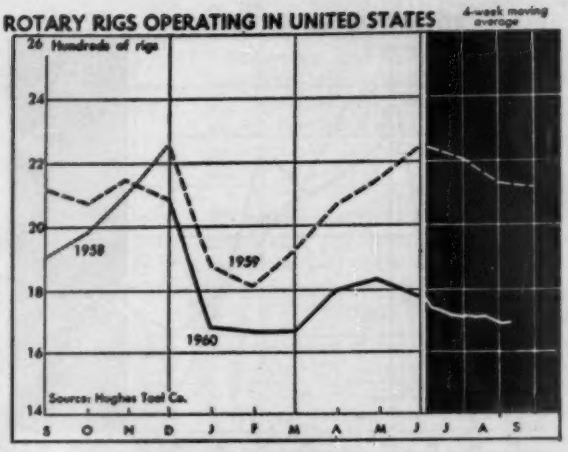
	September 10, 1960 — Crude oil	Lease condensate	Total	Sept. 3 total
Alabama	21,000	.....	21,000	17,500
Arkansas	79,900	250	80,150	80,050
California	834,000	.....	834,000	833,100
Colorado	132,100	.....	132,100	133,000
Eastern	41,000	.....	41,600	40,200
Florida	900	.....	900	975
Illinois	214,900	.....	214,900	219,100
Indiana	31,500	.....	31,500	31,900
Kansas	†296,510	.....	†296,510	†294,615
Kentucky	59,700	.....	59,700	60,200
Louisiana	952,500	123,400	1,075,900	1,072,575
North	105,500	5,900	111,400	111,650
South	847,000	117,500	964,500	960,925
Michigan	41,800	.....	41,800	41,700
Mississippi	132,000	3,550	135,550	134,575
Montana	83,100	.....	83,100	83,650
Nebraska	65,400	.....	65,400	66,700
Nevada	100	.....	100	100
New Mexico	287,500	8,000	295,500	297,275
North Dakota	66,400	.....	66,400	65,900
Oklahoma	†502,600	.....	†502,600	†467,300
Texas	2,380,000	81,500	2,461,500	2,442,925
Dist. 1	42,000	2,500	44,500	43,775
Dist. 2	98,000	8,000	106,000	104,575
Dist. 3	306,000	36,000	342,000	344,150
Dist. 4	171,000	12,200	183,200	179,625
Dist. 5	26,000	300	26,300	26,300
Dist. 6	109,000	9,800	118,800	116,650
East Texas field	124,000	.....	124,000	122,575
Dist. 7-B	129,000	125	129,125	128,400
Dist. 7-C	113,000	3,050	116,050	113,200
Dist. 8	960,000	7,000	967,000	960,575
Dist. 9	195,000	1,600	196,600	195,175
Dist. 10	107,000	925	107,925	107,925
Utah	94,200	.....	94,200	96,700
Wyoming	359,600	.....	359,600	358,800
Others	‡1,650	.....	‡1,650	‡1,500
Total U. S.	6,678,960	216,700	6,895,660	6,840,340
Change from prev. week, up			55,315	
Canada	†446,600	.....	†446,600	†454,800
Total U. S. prod., Jan. 1-Sept. 10			1,779,636,100 bbl.	
Same period last year (crude plus cond.)			*1,790,698,000 bbl.	

*Includes 47,338,000 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

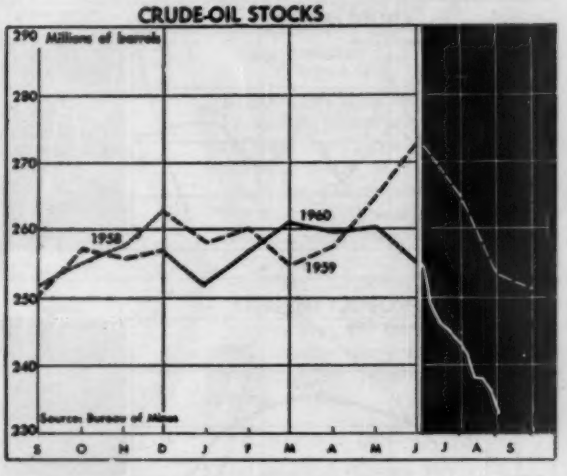
CRUDE-OIL PRODUCTION



ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS

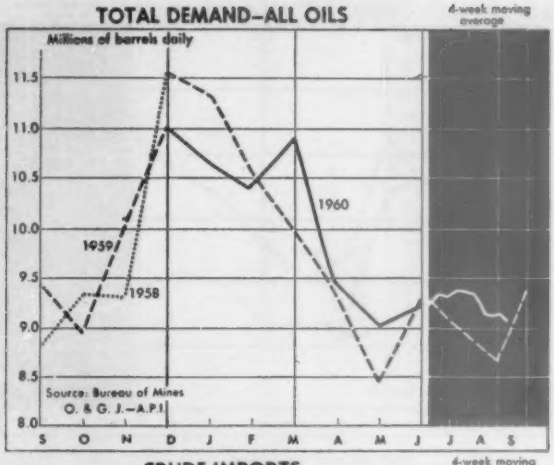


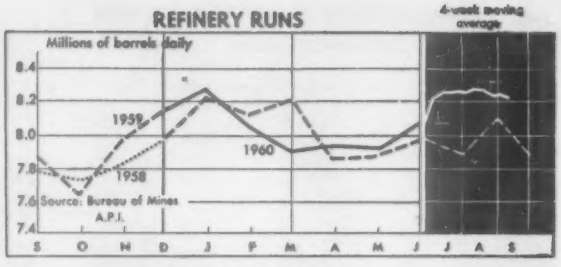
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

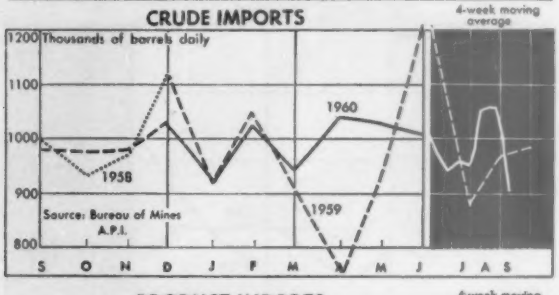
(Thousands of barrels)

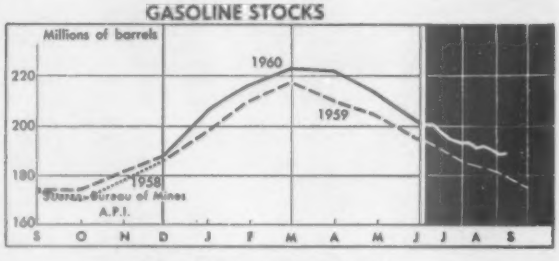
	9-3-60	8-27-60	9-5-59
Pennsylvania	2,323	2,341	2,732
Other Appalachian	1,511	1,576	1,980
Illinois, Indiana, Michigan	9,253	9,053	9,620
Nebraska and North Dakota	2,855	2,824	2,471
Kansas	8,679	8,786	9,867
Oklahoma	14,938	15,793	15,312
Arkansas	1,855	1,800	2,218
Louisiana	18,341	18,027	18,666
North	2,908	3,151	3,366
South	15,433	14,876	15,300
Mississippi, Alabama, Florida	2,036	2,565	2,467
New Mexico	7,836	8,130	8,203
Texas	98,034	99,592	106,817
East Texas	7,792	7,571	8,476
West Texas	46,847	48,936	49,739
Texas Gulf	16,333	16,107	18,537
Other Texas	27,062	26,978	30,065
Wyoming	14,893	14,960	16,122
Other Rocky Mountain	9,664	9,450	9,767
California	26,699	26,863	30,720
Foreign	†13,652	14,471	14,986
Total	232,569	236,231	251,948

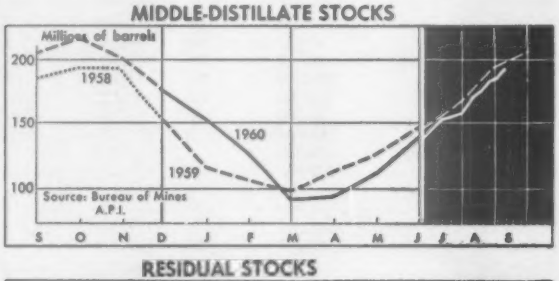
*Bureau of Mines. †Includes 3,546,000 bbl. in California.

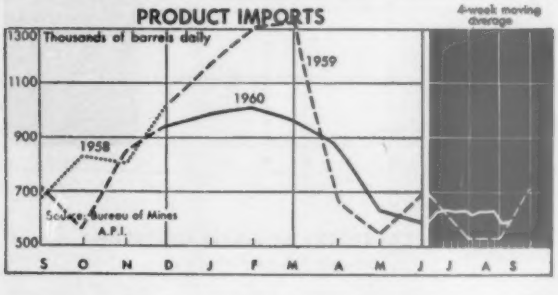


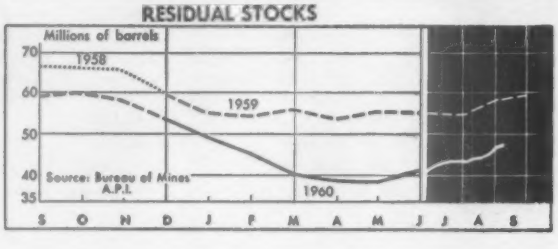












API REFINERY REPORT, SEPTEMBER 9, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,195	531.7	37.0	333.1	143.1	44,210	13,378	59,155	12,728	1,065	520.0	30.8	321.1	151.0
Appalachian:														
District 1	102	42.9	5.4	24.4	7.4	5,741	784	3,772	460	97	41.8	2.6	21.4	6.2
District 2	98	57.9	8.6	18.6	9.7	3,047	448	1,621	322	96	52.9	5.6	16.8	6.2
Ind., Ill., Ky. ...	1,479	794.4	87.5	315.3	141.3	32,766	7,297	28,126	5,721	1,441	775.5	61.5	298.0	135.9
Minn., Wis., Dak.	129	60.1	5.1	30.7	17.0	6,128	1,592	7,741	591	104	49.6	4.6	27.0	11.0
Okla., Kans., Mo.	733	427.4	8.7	195.9	14.1	17,118	1,832	13,568	967	737	412.0	8.8	189.4	22.1
Inland Texas ...	299	222.7	10.0	50.7	19.1	6,598	609	1,540	2,538	276	217.7	7.1	47.9	21.0
Tex. Gulf Coast	1,968	991.9	135.2	445.8	162.8	24,085	3,472	16,793	5,604	1,795	911.7	86.9	420.1	138.8
La. Gulf Coast.	655	373.1	62.6	153.3	35.0	10,899	2,157	6,986	1,481	706	377.7	61.1	147.8	49.2
N. La. and Ark..	109	59.3	5.7	19.7	7.6	5,602	1,099	1,946	132	73	33.5	3.1	13.9	5.4
Rocky Mountain:														
New Mexico..	26	12.9	0.4	4.7	3.4	591	52	185	5	23	12.1	0.2	4.4	2.1
Other	307	138.7	4.4	65.6	34.7	5,009	389	3,012	979	305	145.9	3.3	61.7	32.3
West Coast	1,179	573.3	27.0	191.2	297.7	27,092	1,412	14,663	16,265	1,160	521.8	1.2	175.7	271.5
Sept. 9, 1960..	8,279	4,286.3	397.6	1,849.0	892.9	188,886	34,521	159,108	47,793	7,878	4,072.2	276.8	1,745.2	852.7
Sept. 2, 1960..	8,294	4,171.4	385.9	1,824.9	861.0	188,665	33,884	153,023	47,078	.....	.....	.....	.....	.....
Sept. 11, 1959.	8,181	4,212.9	311.4	1,705.4	871.1	183,491	32,787	168,578	58,778	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00-3.05**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- ★ Arabian, 34.0°-34.9°, Ras Tanura $1.80
- ★ Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- ★ Iranian, 34.0°-34.9°, Abadan 1.73
- ★ Iraq, 35.0°-35.9°, Fao 1.72
- ★ Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- ★ Qatar, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- ★ Arabian, 34.0°-34.9°, Sidon $2.17
- ★ Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- ★ Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- ★ Gulf-NY, clean (ATRS—10%) $2.57
- ★ Carib.-NY, dirty (ATRS—55%) 1.24
- ★ PG-UK, dirty (Scale—52.5%) (29s. 0d.) 4.06
- ★ Sidom-NY, dirty (ATRS—65%) 2.73

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 12.25-12.50
- Premium (99 octane) . 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) . 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.125-10.25
- Premium (97 octane) . 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ....10.125-10.375
- Diesel oil (58 d.i. and above) 9.75-10.00
- Distillate No. 1 ..... 9.75-10.00
- Distillate No. 2 ..... 8.75-9.00

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00-9.25
- Distillate No. 2 ..... 8.25

New York Harbor (barges):
- Kerosine 41-43 ..... 10.15
- Distillate No. 2 ..... 9.15
- Diesel fuel, 48-52 d.i.. 9.45

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C $2.10

California (rack):
- Bunker C fuel, Los Angeles $2.15

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TRAILER MOUNTED FRANKS "COMET 35" rotary drilling rig powered by GM 6-110 diesel. Excellent condition. Rig complete, less pump and drill string. Priced for immediate sale. Box L-978, The Oil and Gas Journal, Tulsa, Oklahoma.

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ONE—6¼ x 10 EMSCO Triplex Mud Pump. Type A-10. New valves, rods, and heads. 48" 10 groove sheave, belt guard, suction screen and suction. $2,500.00, good condition. American Welding Works. Cushing, Okla.

Stops corrosion problems in refineries, oil fields, distribution equipment, filling station underground pipe installations, etc. Write for details. Free sample. GALV-WELD PRODUCTS, Dept. OGJ, P. O. Box 1303, Bradenton, Florida.

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2,000,000 ft. 2"	3.50# to the ft.
1,000,000 ft. 3"	7.70#
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400,000 ft. 10¾"	35#
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50,000 ft. 18"	59#

All No. 1 Grade Plain end and cleaned.

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REBUILT RA-3 Clark Compressor. Advise specifications your requirement: will quote suitably cylindered. Sperbeck Steel, Inc., Box 19351, Houston. Phone: HO-81317.

LUFKIN 74" STROKE PUMPING UNIT
228,000# Peak Torque—Single Reduction
6.000' 7" OD Casing, 24# Seamless R-2 10V thd.
5,280' 3" OD 7.57# Beveled Line Pipe
6 & 10 Ton YALE Triplex Spur-Geared Chain Hoists
300 sq. Ft. Steel U-Tube Reboiler
HEAT & POWER CO., INC.
310 Thompson Building, Tulsa 3, Okla.

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3,200' 5½" J55 14# Range, 2	$1.40 ft.
4,500' 2" Reg. H40 Range, 2	.40 ft.
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1—BS&B 36" I.D. 600# Separator like new, ½ new price.
1—OCS 40 H.P. Twin Crank 74" stroke Polly Pumping Unit $3,500.
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HEAT EXCHANGERS

Steel Tube: 3280, 2100, 1200, 950 sq. ft.
Adm. Tube: 2800, 2700, 2600, 2100, 1700, 1500 1375, 1250, 1100, 1000, 920, 650 sq. ft.
20 Fin Tubes: 50-190 sq. ft.

VESSELS & TOWERS

8' x 75' 20 Tray 25#	4' x 36' packed 210#
7½' x 56' 20 Tray 35#	10' x 55' 60#
3' x 38' 30 Tray 134#	8' x 43' 60#
3' x 47' 20 Tray 120#	6' x 42' 200#
18" x 32' 15 Tray 130#	6' x 20' 40#
2' x 30' packed 50#	12' x 43' 25#

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Hot Oil: 1"-6"; 50-400 gpm 100-3,000 ft. hd.
Boiler Feed: 190 gpm 1,500' hd.
Cooling Tower: 7,000 gpm 120' hd.
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15 Storage Tanks welded: 29,000, 10,000, 5,000, 3,750 barrel.
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1—Carrier 853 ton refrigeration Compressor Turbine drive. (1953)
2—IR Turbo Exhausters 15,300 & 17,000 CFM 4.85 PSIG with Turbine Drives.
1—Clark Centrifugal Compressor 10,000 CFM—240 PSI discharge. (1953)

OTHER FEATURED ITEMS

1 Lummus: 35 mil. BTU furnace
2 Petro-Chem. Furnace: 1¼ mil. & 8 mil. BTU
2 B&W Boilers: 70,000# per hr.-450#
1 IR-XVG-4 Compressor
1 Worth LT-6 Compressor

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BRILL EQUIPMENT COMPANY—DESTREHAN, LA.—NORCO 6571
4101 San Jacinto St. Houston 4, Texas, JA 6-1351
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In extra good condition. $3,500.

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FOR SALE—Model 33C Walker Neer service and drilling unit, mounted on International tandem truck, 140 HP Waukesha engine, heavy duty 8" 65' double mast, 4,000' ⅞" drilling line, 5,000' ¾" sand line, 400' ¾" casing line, steel dog house, light plant mounted on truck and some light drilling tools. Machine and truck in first class condition has drilled very little new hole. One and one half years old and will sell for less than half of its cost. P. L. Crandell Company, 1404 Wilco Bldg., Midland, Texas.

ENGINES—PUMPS

2—Cooper-Bessemer Type JS-5-G, 330 H.P. @ 350 r.p.m., 13" x 16", 5 Cyl., 4 Cycle, Vertical Natural Gas Engines, fully equipped.

3—National Transit 5¾" x 18" Hor. Dup. Power Pumps, G. R. 5.95:1, Cap. 15,000 B. D. @ 1,000 psi.

1—Steel Building 56' wide, 100'-6" long, 16'-3" high, Steel Frame, Corrugated Transite Walls and Roof, like new condition.

Above three items located Lake St. John, La.

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Two above items located Cranfield, Mississippi.

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AN INDIVIDUAL desires to buy 75 to 100 barrels per day of good settled production. Will pay the highest price, all cash. Please write to Milton Gessner, Laconia Building, Wheeling, W. Va.

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Inquiries held confidential.

Forward resume,
including education, background and references to:

Box L-991
The Oil and Gas Journal
Tulsa, Oklahoma

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BAKER & TAYLOR Drilling Co., needs derrickmen, motormen, rig helpers.; steady employment, paid vacations, Hospitalization & life insurance, safety program. Contact any Baker & Taylor toolpusher at, Spearman, Perryton or Canadian, Texas.

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Liberal salary—plus allowance, bonus and other benefits.

Qualified candidates submit detailed experience summary and personal data to:

BOX L-996
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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PLANT SUPT.—Engineer: Desires employment with small oil company, independent operator or gas transmission company. 23 years experience in all phases of gasoline plant operation. Supervisor for over 19 years. Experience includes general plant engineering, plant design and layout, plant construction, plant maintenance, laboratory, gas and product sales. Presently employed. Experience with independent operator and major oil company. Box L-985, The Oil and Gas Journal, Tulsa, Oklahoma.

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GEOLOGIST-STRATIGRAPHER 33, Masters, family, extensive exploration, research experience, consider any position or location. Box L-988, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT with 30 years experience, would like to make connections with oil refinery needing help. Write: Box L-989, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL ENGINEER BS—13 years experience, economics, design construction, operation products, crude oil, natural gas pipelines. 37 years old. Resume on request. Box L-990, The Oil and Gas Journal, Tulsa, Oklahoma.

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PETROLEUM GEOLOGIST, mature lady, mid-continent area experience. Box M-100, The Oil and Gas Journal, Tulsa, Oklahoma.

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PETROLEUM GEOLOGIST: now consultant, 23 years experience Appalachian area, Ohio, Michigan, Tri-State, Mid-Continent. Good oil and gas finder. Executive experience. Open for stable position. Box L-999, The Oil and Gas Journal, Tulsa, Oklahoma.

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U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 40 acres of land in one parcel, within the known geologic structure of the Harrisburg field, Banner County, Nebraska, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, October 26, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 407.40 acres of land in 3 parcels within the known geologic structure of certain fields in Beaver and Kingfisher Counties, Oklahoma will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 2:00 p.m., MST, October 4, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 837.65 acres of land in six parcels within the known geologic structure of Bar-X Field, Mesa County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., October 26, 1960, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. Dale R. Andrus, Land Office Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 320 acres of land in one parcel, within the known geologic structure of the Hugoton field, Morton County, Kansas, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., MST, October 19, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

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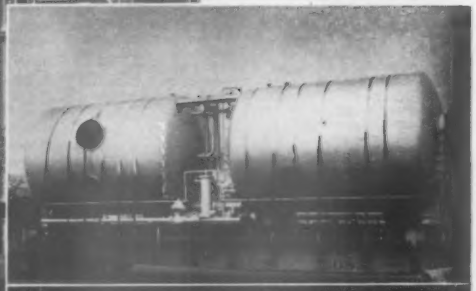

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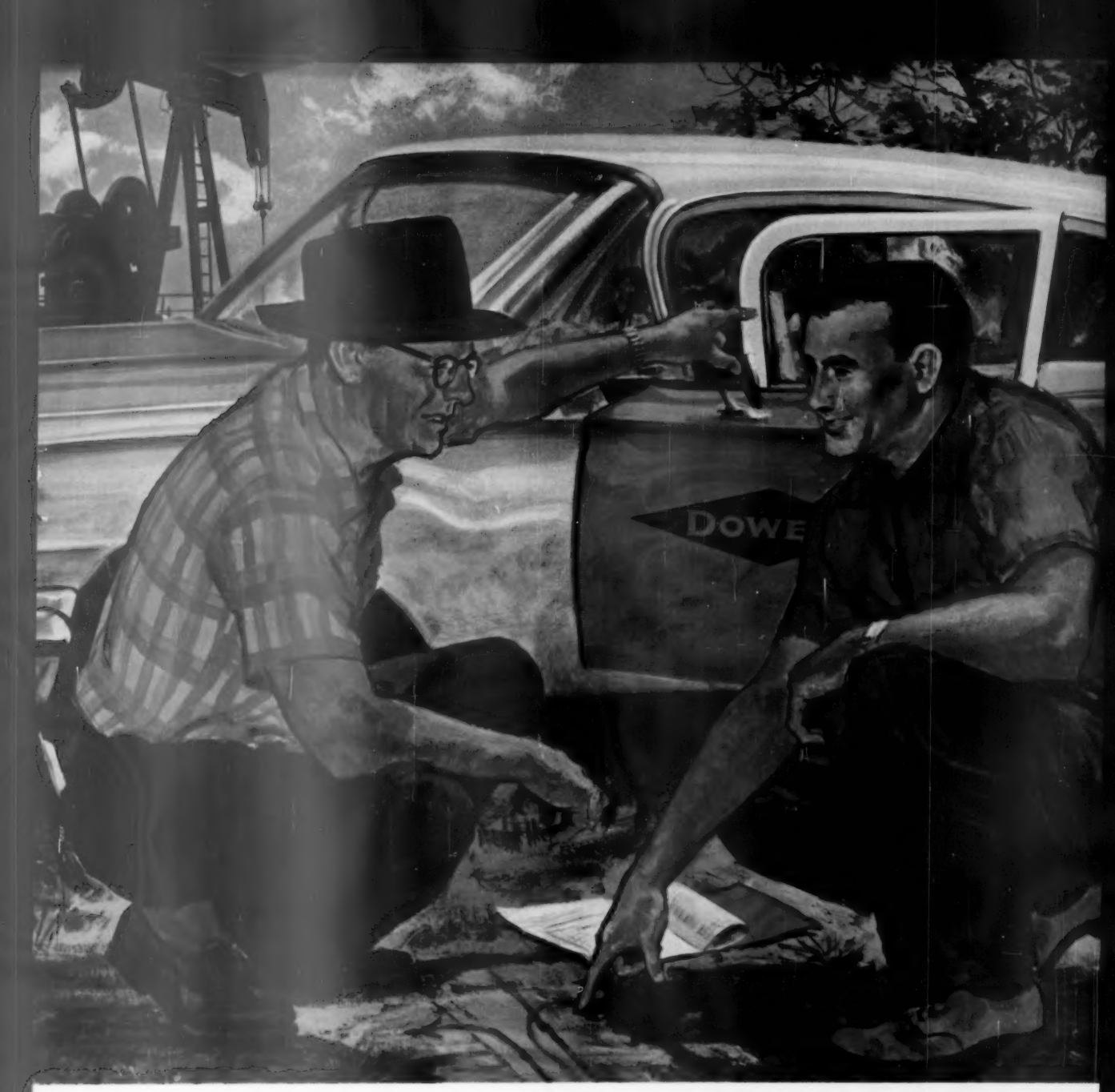

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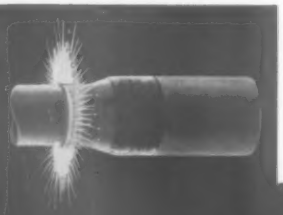

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